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H.R. 1066—THE INDOOR AIR QUALITY ACT OF 1991

HEARING

BEFORE THE

SUBCOMMITTEE ON ENVIRONMENT

OF THE

COMMITTEE ON
SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

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H.R. 1066—THE INDOOR AIR QUALITY ACT OF 1991

THURSDAY, MAY 9, 1991

U.S. House of Representatives,
Committee on Science, Space, and Technology,
Subcommittee on Environment,
Washington, D.C.

The subcommittee met, pursuant to call, at 10:10 a.m., in room 2318, Rayburn House Office Building, Hon. James H. Scheuer [chairman of the subcommittee] presiding.

Mr. Scheuer. The Subcommittee on Environment will come to order, and this morning we will be considering H.R. 1066, the Indoor Air Quality Act of 1991.

Indoor air pollution was first addressed in this subcommittee in 1983 when Congresswoman Claudine Schneider of Connecticut and I first put in a bill addressed to indoor pollution—in particular, radon. In 1986, we were the impetus behind SARA, the Superfund Amendments Reauthorization Act, title IV, which gave EPA its first explicit authority to combat the threat of radon and indoor air pollution. This morning, the subcommittee continues its discussion of this important public health issue.

Indoor air contamination comprises a serious and widespread health threat; we know that now. Nobody was thinking along those lines back in 1983, least of all the administration, least of all the EPA. In its 1987 report entitled "Unfinished Business," EPA, after three or four years of thinking about it, ranked indoor air pollution as a greater environmental hazard than both hazardous waste sites and outdoor toxic air pollution combined.

In September 1990, just six or seven months ago, in a follow-up report entitled "Reducing Risk: Setting Priorities and Strategies for Environmental Protection," the independent Science Advisory Board ranked all environmental risks, and, of course, indoor air pollution was one of the four greatest relative risks to human health.

In EPA's 1988 survey of 10 public buildings and its more recent survey of pesticides in homes, the EPA concluded that the concentration of many indoor pollutants exceeds the level found outdoors. The health threat is accentuated by the fact that most Americans spend perhaps up to 90 percent of their time indoors.

The cost to our economy in health care and lost productivity alone has been estimated to be in the range of tens of billions of dollars, and the time has come for us now to confront indoor air pollution with a Federal effort that is commensurate with the threat that it poses to the economy and to the public health.

The bill that is before the subcommittee today, H.R. 1066, the Indoor Air Quality Act of 1991, sets out a proposal for expanded research and improved Federal coordination of efforts to diagnose and abate indoor air contamination. H.R. 1066 is, for the most part, comparable to H.R. 5155, as passed by the science committee in the last Congress. In addition, H.R. 1066 contains three new sections. These are, in effect, provisions addressing ventilation standards, emissions labeling for products that contain indoor contaminants, and workplace standards for exposure to indoor pollutants. The new provisions will be the focus of our hearing this morning.

I look forward to the testimony of the many experts that are gathered here today, and I would like to commend the author of this bill, the distinguished gentleman from Massachusetts, Representative Joe Kennedy, for his leadership on this critical issue.

All right. We have the first panel before us. Let's go right down the line.

Excuse me. Before we go to the panel, I would like to recognize my colleague, Congressman Don Ritter of Pennsylvania, a very hard working and constructive and talented member of this subcommittee.

Mr. RITTER. Mr. Chairman, thank you very much for that delightful introduction.

I wish to commend you, Mr. Chairman, for your leadership for many years on the broad set of issues related to indoor air quality. I share your concern that the air that we breathe in our workplaces and our residences, where we spend an estimated 90 percent of our time, must be healthy.

Indeed, you may recall that I was an original cosponsor of your bill dealing with the health effects of smoking in indoor spaces, the Nonsmokers Protection Act of 1986, and I think we also sponsored together some of the initial nonsmoking bills for airlines.

We have come a long way as a society in protecting nonsmokers from the ravages of indoor air pollution coming from cigarettes, cigars, and other kinds of smoking—smokers' pollution. And, what we need to do is have a little progress in some of our Committee rooms, where, usually, the highest ranking people are the ones that smoke cigars, and us lower ranking people have difficulty in convincing them to cease and desist.

But, assuring that indoor air is clean and does not pose—maybe we need an amendment, Mr. Chairman, for our Committee rooms or something. Assuring that indoor air is clean and doesn't pose a significant health risk continues to be of paramount concern for our national well-being.

On a personal level, many people feel discomfort, sometimes severe, at the presence of a wide variety of substances in indoor air. The causes of these health problems may not be fully understood and may, as some have suggested, push the frontiers of science. There can be no doubt that finding the answers is important. In fact, EPA's independent Science Advisory Board consistently ranks indoor air hazards as a problem worthy of urgent attention.

Characterizing the effects on human health of the extraordinary number of substances found indoors is a rather enormous undertaking. People in indoors are exposed to a considerable number of potential contaminants. The sources of these exposures and the reactions of individuals involved vary greatly.

While the Federal effort in indoor air quality research is growing stronger, it is a long way from linking most individual substances to specific health impacts. So, more research and good science needs to take place to focus on the connection between symptoms and syndromes.

The Science, Space, and Technology Committee, and the Subcommittee, in particular, has assumed a leadership role on the issue of indoor air quality, as the Chairman noted in his opening remarks. In the 101st Congress, the Committee reported H.R. 5155, the Indoor Air Quality Act of 1990. Today, we will hear from our witnesses on the provisions of H.R. 1066, which incorporates new sections dealing with ventilation standards, product emissions, labeling, and workplace indoor air quality protection. This bill goes substantially further in a regulatory sense than previous legislation.

Mr. Chairman, I look forward to working with you on this important legislation, and I welcome our distinguished witnesses here today.

Mr. SCHEUER. I thank my colleague, and I know he joins me in hoping that the glories of the year 1066, that benchmark year in the annals of human history, will be matched by the glories of 1991.

Mr. RITTER. Isn't that the year the French invented quiche?

Mr. SCHEUER. Here I was, trying to ennoble this hearing with memories of William the Conqueror crossing the English Channel.

Mr. RITTER. The Battle of Hastings, or something.

Mr. SCHEUER. Right.

Okay. Our first witness on this splendid panel will be Dr. Michael Shapiro, deputy assistant administrator for air and radiation of the EPA here in Washington.

Excuse me, Doctor. We have 11 witnesses this morning, and we are going to be very much pressed for time, so I am asking all the witnesses to adhere strictly to the five-minute rule. Your prepared testimony, of course, will be printed in full at the point in the record where you testify, okay?

STATEMENTS OF MICHAEL SHAPIRO, DEPUTY ASSISTANT ADMINISTRATOR FOR AIR AND RADIATION, ENVIRONMENTAL PROTECTION AGENCY, WASHINGTON, D.C.; ERIC PETERSON, EXECUTIVE DIRECTOR, CONSUMER PRODUCT SAFETY COMMISSION, BETHESDA, MARYLAND; CYNTHIA DOUGLASS, DEPUTY ASSISTANT SECRETARY FOR OS&H, OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION, WASHINGTON, D.C.; AND JOHN MILLHONE, DEPUTY ASSISTANT SECRETARY FOR BUILDING TECHNOLOGIES, DEPARTMENT OF ENERGY, WASHINGTON, D.C.

Dr. SHAPIRO. Thank you, Mr. Chairman.

Mr. Chairman and members of the subcommittee, I am pleased to be here today to testify on the topic of indoor air quality, which, as you pointed out, is one of the most important and urgent public health problems facing the EPA.

In my testimony, I would like to report briefly on the important progress that we have made in this area and to reflect on some aspects of the proposed legislation.

At the outset, I should say that while the agency shares your goals with respect to addressing this problem and acknowledges your leadership in this area, we believe that new legislation at this time is premature, unnecessary, and in some respects potentially disruptive to our current efforts.

As you pointed out, the indoor air pollution problem is an extremely complex one. In certain cases where a considerable amount of work has been done, we have been able to attribute specific problems, such as cancer, to particular sources, such as asbestos or indoor radon. However, in a number of respects the situation with respect to many of the other contaminants that we find in indoor air is extremely complex both with respect to long-term effects as well as with respect to short-term acute effects that collectively are frequently referred to as the sick building syndrome.

Experts believe that the characteristics that have been exhibited and the complaints are the result of a variety of different factors, no one of which has been specifically identified as of yet. Finally, there are emerging and highly controversial issues concerning health concerns from multiple chemical exposures.

EPA, in coordination with other Federal agencies, has developed a three-pronged approach for addressing these serious problems, recognizing their complexity. First, in areas where we have been able to identify specific individual pollutants and methods for addressing them, as in the case of asbestos or radon, we have moved forward actively with programs to address these problems in both regulatory and nonregulatory contexts.

Second, EPA is moving aggressively to accelerate research that will lead to a better understanding of the causes and solutions to indoor air problems. Between 1991 and 1992, EPA proposes to more than double its research funding in this area, including important work in the area of characterizing problems in large buildings, understanding better the nature of the problems associated with particular pollutants, and working on improved mitigation techniques.

Third, while this work is ongoing, EPA is taking effective steps to transfer what we do know about risk and risk reduction into an effective program. The approach which the agency is taking seeks to achieve real and significant reduction in exposure to all biological and chemical contaminants in indoor settings. Our approach revolves around two simple policy principles: first, that it is prudent to minimize human exposure to biological and chemical contaminants indoors; and, second, that reductions in exposure can best be achieved by utilizing an integrated strategy of source control wherever feasible, provision of adequate ventilation at all times, and, where appropriate, use of air cleaning technologies as an adjunct to the first two.

We are implementing this strategy through the development of technical guidance materials, informational documents, educational and outreach programs, most conducted jointly with other Government agencies and private sector partners. These include, for example, our carpet policy dialogue with the members of the carpet industry and the public, the guide to workplace smoking policies which is currently completed scientific review, various guides for building managers, architects, school facility managers, and home builders, as well as physicians' guides, development of training courses for State and local government personnel, as well as development and dissemination of general informational documents for the public. To support this ambitious effort, EPA has increased the resources devoted to our indoor air program over tenfold from 1989 through 1992.

Will new legislation help this effort? We don't think so. Many of the provisions of the proposed legislation duplicate existing authorities. Where new mandates are imposed, we think that they are unwarranted or premature.

With respect to ventilation standards, we believe that locking in particular values at this point would be inappropriate. With respect to product labeling, we believe that EPA and other agencies already have adequate authority to address this problem where we have adequate scientific knowledge to deal with it, and, in most cases at the moment, we do not.

Thank you.

[The prepared statement of Dr. Shapiro follows:]

STATEMENT OF
MICHAEL H. SHAPIRO
DEPUTY ASSISTANT ADMINISTRATOR
FOR
AIR AND RADIATION
U.S. ENVIRONMENTAL PROTECTION AGENCY
BEFORE THE
SUBCOMMITTEE ON ENVIRONMENT
OF THE
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

May 9, 1991

Mr. Chairman, members of the Subcommittee, I am very pleased to come before you today to testify on the topic of indoor air quality, one of the most important emerging issues the Agency has on its agenda, and to report to you what I believe is substantial progress in developing an effective Federal response to the indoor air problem. While there are still large gaps in our knowledge about many aspects of indoor air quality, I come before you today confident that we are on the right track in dealing with the many issues and challenges presented by the indoor environment. Our approach is based on an integrated strategy of research, effective pollutant-specific risk management programs, and a pollution prevention strategy that focuses on improving all indoor air quality related aspects of building performance.

I must say at the outset, however, that the Administration believes even more strongly than it has in the past that new indoor air legislation at this time is premature, unnecessary from the standpoint of either authority or resources, and, of greatest concern, potentially disruptive to the momentum which we have built up in this area. While I will address these concerns later in my testimony, I would like to begin by attempting to address the specific areas on which you have asked us to testify and to describe for you our current policy and program direction.

THE PROBLEM

Much of the growing concern about indoor air pollution is due in part to a convergence of a number of studies and findings indicating that many people's exposure to range of air pollutants often occurs predominantly indoors, where people spend approximately 90% of their time. EPA's Total Exposure Assessment Methodology -- or TEAM -- studies, have documented this for carbon monoxide, volatile organic compounds, and pesticides, and a current TEAM study of particles, while only recently completing the data collection phase, suggests a similar pattern. A considerable amount of detail on our current understanding of the major indoor air pollutants, their sources, health effects, risks, and the economic implications of indoor air pollution is contained in EPA's 1989 *Report to Congress on Indoor Air Quality.*

The sources of these exposures are as numerous and varied as the many materials which comprise our building structures and interior furnishings, the thousands of products which are integral to our lives within buildings, our own personal activities, the soil on which our buildings rest, and the range of pollutants present in outdoor air, which for all intents and purposes currently establishes the baseline for indoor air quality. In addition, the ventilation system itself is a critical determinant of pollutant levels and indoor air quality in buildings, both as a significant potential sources of biological pollutants as well as the means for controlling other pollutants.

The studies that have been conducted to date by EPA, other Federal agencies, and the private sector have led to concern that people are being exposed to levels of pollutants that may be significant in terms of long term risks of cancer and other chronic effects; thus the very high ranking for indoor air in many of the recent relative risk reports prepared by EPA and, most recently, by the Agency's Science Advisory Board. Our level of understanding about these risks, however, is extremely limited except for a very few pollutants, most notably asbestos, radon, lead, and environmental tobacco smoke. For example, EPA estimates that thousands of excess lung cancer deaths may be caused each year as a result of exposure to radon and the synergistic effects of radon and tobacco smoking. These estimates are now undergoing review and possible revision, as I will discuss in more detail later in my testimony. Lung cancer deaths have also been associated with exposure to environmental tobacco smoke. Lead has been shown to cause brain damage in children and asbestos is a documented cause of lung diseases. For asbestos and radon, the Agency has undertaken major risk management programs, and we are developing risk management efforts as well for lead and environmental tobacco smoke. The long term risks associated with exposure to the myriad other indoor pollutants, however, are far less well-characterized or understood.

Even less well understood are the more immediate effects of exposure to indoor contaminants in buildings. As you are no doubt aware, there appears to be an increasing incidence of health complaints associated with poor indoor air quality in the nation's public and commercial buildings, schools, and residences. These complaints can involve a variety of symptoms such as eye, nose, and throat irritation, headache, lethargy, dizziness and dozens of other symptoms for which specific causes cannot be identified and which have come to be known collectively as "sick building syndrome". While a number of hypotheses have been advanced to explain sick building syndrome, including exposure to low levels of individual or mixtures of volatile organic compounds (VOCs), many researchers believe that there is no single explanation, but rather that occupant reactions to air quality indoors can be impacted by many factors which are extremely difficult and often impossible to sort out. These factors include exposure to a variety of chemical and biological contaminants; comfort factors such as temperature, humidity, ventilation (outside air supply and air movement), and lighting; odor, which has a very strong perceptive influence; and psychosocial factors, including job stress and environmental aesthetics.

At the same time, there are a number of illnesses which *can* be directly and demonstrably related to environmental pollutants in buildings, ranging from well known and life-threatening diseases such as Legionnaire's disease, to a variety of specific allergic or other reactions, most of which are caused by biological, rather than chemical, contaminants.

Finally, there are emerging and highly controversial health concerns, such as the phenomenon of multiple chemical sensitivity (MCS), in which a segment of the population reports that acute exposures to individual chemicals, or mixtures of chemicals, and perhaps even repeated exposure to very low levels of chemicals, have resulted in a heightened sensitivity to many chemicals which they are exposed to in their day-to-day lives. While the cause or causes of their health problems are still the subject of much debate, there is no question that these people's lives are being affected in devastating ways.

Unfortunately, information on the health impacts of low concentrations of indoor pollutants is extremely sparse and health impact assessments are made even more complex by the varying sensitivity of different segments of the population to indoor pollution. Just as some people have varying sensitivity to allergens, ranging from no allergic reactions whatsoever to individuals who are virtually disabled by allergies, it is probable that such a range of responses might also exist for exposure to chemicals. The fact that some people suffer significant irritant reactions to tobacco smoke while others are not bothered at all is a good example. The range of populations potentially sensitive to indoor contaminants, from children to asthmatics to the elderly or those with pre-existing conditions, add to the difficulty in assessing policy choices for how to protect as much of the population as possible, while still retaining a sense of what is achievable, and what actions are reasonable.

It is critically important that this subcommittee and others understand that we are pushing the frontiers of science here, and that expectations that we can answer these difficult health questions in the next few years and be able to quantify the risks associated with all indoor pollutants are not realistic. As I will describe in more detail later, these uncertainties have an impact on policy development, and figure prominently in our current and future strategic planning.

Other unknowns and uncertainties also compromise our ability to neatly package indoor air quality problems into simple, easily-fixed components. For example, the fact that many suspected indoor air quality problems go undiagnosed and unsolved, the lack of clearcut criteria for identifying a "problem building", and the absence of any nationwide survey of buildings to establish baseline information on complaints or other problem indicators makes it impossible to estimate just how large an indoor air pollution problem we are dealing with in this country.

Efforts to estimate both the costs of indoor air pollution to society, as well as estimates of the costs of controlling indoor air pollutants, are in their infancy. An initial effort by EPA to estimate the costs of indoor air pollution concluded that although specific cost estimates were virtually impossible due to data limitations, it was reasonable to estimate that the costs of indoor air pollution in terms of direct medical costs and lost productivity was probably in the tens of billions of dollars per year. The Agency has begun a multi-year effort to look at the cost implications of a number of indoor air quality control strategies, and information from this effort will help to assess the appropriateness of various control technologies.

While these complexities make the indoor air issue extremely difficult to define, we know enough about the problem to conclude that the risks, both acute and chronic, are significant, and warrant a coordinated and intensive Federal response.

THE STRATEGY

As you know, EPA has, for the most part, taken a pollutant-by-pollutant approach to environmental control since its inception, and this approach is often absolutely appropriate for addressing a myriad of known and suspected health risks arising from exposure to these compounds. With respect to chemicals, EPA has been given extremely broad and powerful authorities under the Toxic Substances Control Act (TSCA) and the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) to address chemical exposure risks. While we need to find ways to better use these statutes to control risks related to exposure to individual compounds, several program initiatives are underway within the Agency to improve our utilization of these statutes and to integrate them with the broad framework of indoor air exposures. These initiatives include a clustering approach to screening indoor pollutants and indoor pollutant sources more expeditiously and a graduated response to risk reduction which seeks to increase the flexibility with which our TSCA authority can be used. Simultaneously, we are attempting to accelerate research devoted to low-level exposure to indoor air contaminants.

At the same time, however, the Agency is committed to an entirely new approach to resolving indoor air quality issues, which we believe is necessitated by the variety of building factors, pollutants, and sources in the indoor exposure equation, and by the very real limitations of science to address the health effects issues of low level exposures in the near term. The approach which the Agency is taking is a strategy that seeks to achieve real and significant reductions in exposure to all biological and chemical contaminants indoors, quickly, by employing prevention techniques aimed at reducing all risks. Our approach revolves around two simple policy principles. First, that it is prudent to minimize human exposure to biological and chemical contaminants indoors. Second, that reductions in exposure can best be achieved by utilizing an integrated strategy of source control wherever feasible, provision of adequate ventilation at all times to all occupied spaces, and, where appropriate, use of air cleaning technologies as an adjunct to (but not a replacement for) the first two strategies.

The essence of the strategy is to focus on the way in which buildings of all types are designed, constructed, operated, and maintained. The focus on building performance ensures that all potential indoor pollutant sources receive adequate attention, and that the critical elements of ventilation system performance, building maintenance, and occupant activities are integrated into a cohesive strategy. Such a strategy would both minimize the potential for indoor air quality problems to develop and occupant complaints to escalate, and ensure that practical cost-effective problem identification and problem-solving tools are provided to those is a position to affect the quality of the indoor environment.

THE EXPANDING AGENCY COMMITMENT

EPA is moving expeditiously to implement this strategy on both the research and policy fronts. In its 1989 *Report to Congress on Indoor Air Quality*, EPA made several recommendations for how the research and programmatic aspects of indoor air should be advanced, and suggested that major resource increases would be needed to fulfill the needs identified. I am pleased to report to you that the Agency has begun a serious effort to implement these recommendations and while much work remains, we are committed to applying the resources necessary to get the job done.

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Since 1989, the budget of the Indoor Air Division, the group responsible for the Agency's indoor air policy and programmatic activities, has grown from just $350 thousand a year to a $5.5 million request in the President's 1992 budget. In FY 92, the President's budget would also double the Office of Research and Development's indoor air research program to $5.3 million and enhance the Agency's ability to focus in the important indoor air quality research areas: health effects; source assessment and control; building studies and methods; risk assessment; and development of a biocontaminant control program. It is also important to note that these numbers do not reflect the Agency's spending on other indoor air issues. Significant Agency resources have been and are being applied to control a variety of specific indoor air pollutants, including radon, asbestos, lead, mercury in paint, and a host of other indoor exposure issues. In addition, research being conducted through the Agency's Total Human Exposure Program, which figures prominently in our understanding of indoor air exposures, is not included in the indoor air research budget numbers.

THE PROGRAM

EPA, in close cooperation with a large number of public and private sector agencies and organizations, has made substantial progress in implementing the recommendations in the 1989 *Report to Congress on Indoor Air Quality,* as well as the exposure reduction strategy described earlier. I would like to highlight for you some of the major activities which are underway to implement these recommendations within the indoor air research and policy programs.

Recommendation #1: Research to better characterize exposure and health effects of chemical contaminants and pollutant mixtures commonly found indoors should be significantly expanded.

EPA's Health Effects Research Laboratory has constructed state-of-the-art exposure chambers to conduct studies on both sensitive and normal populations to try to establish measures of human responses to low levels of VOCs. Studies have been conducted in the last year to replicate and extend pioneering work carried out in Denmark, and future studies will look at possible sensory effects on sensitive populations exposed to a complex mixture of VOCs. Development of an animal studies program is also underway to permit testing of VOCs in non-human subjects. These studies will evaluate respiratory, immunological and/or neurological responses and begin to assess the additive or synergistic effects of mixture components. We anticipate that these human and animal studies will improve our understanding of the possible contributions of low levels of VOCs to the sick building syndrome phenomenon.

In addition to this work, the Indoor Air Division funded a very recent workshop sponsored and conducted by the National Research Council (NRC) of the National Academy of Sciences (NAS). Its goal was to develop a research agenda to scientifically explore the issues raised in numerous anecdotal and case reports with respect to the phenomenon of multiple chemical sensitivity I discussed earlier. The workshop, which was attended by a diverse group of medical and other scientific experts, should provide a plan for investigating the MCS phenomenon as well as advancing our overall understanding of the health impacts of exposures to low levels of chemicals.

Recommendation #2: A research program to characterize and develop solutions to biological contaminants in indoor air should be developed.

As I noted earlier, EPA's historical experience in addressing environmental hazards has been focused largely on chemical hazards. However, biological contaminants (i.e., pathogens, allergens, and toxins) in indoor air are largely responsible for known building- related illnesses. These include Legionnaire's disease, hypersensitivity pneumonitis, and a wide range of allergic reactions, all of which have been associated with poor hygienic and maintenance practices in buildings. Any effort to control indoor air pollution must, of necessity, encompass a viable biocontaminant program. While both the National Institute for Occupational Safety and Health, Centers for Disease Control (NIOSH, CDC) and the Consumer Product Safety Commission (CPSC) have done work on biocontaminants, development of effective screening methods for assessing biocontamination and most important, effective strategies for controlling the moisture and nutrients essential for biocontaminant growth must be developed and tested.

The Environmental Monitoring and Support Laboratory of ORD has begun modest methods development work on biocontaminants, and anticipates expanding its initiative in this area in the future. In addition, the Indoor Air Division is funding a major study by the NAS/NRC to characterize what is currently known about indoor allergens and to identify potential areas for research and policy action.

Recommendation #3: Research to identify and characterize indoor air pollution sources and to evaluate appropriate mitigation strategies should be expanded.

A key element of the strategy I discussed earlier is the effective control of sources of indoor air pollution in buildings. If indoor pollutant sources could be eliminated, indoor air quality problems would not exist. Therefore, efforts to control sources to the extent feasible to minimize human exposures are of paramount importance. Consequently, source assessment and control activities are among the top priorities of both the indoor air research program and the Indoor Air Division, and funding for these programs is being increased significantly in FY 92.

On the research side, EPA has pioneered development of a standardized small chamber test method for characterizing emissions from indoor air sources. This method has already been adopted as an ASTM guideline and is being widely utilized by industry and other outside groups as the standard method for determining emission decay rates for chemicals from a range of indoor sources. EPA-developed models for predicting and evaluating levels of contaminants under a variety of scenarios have been developed, and models for predicting the "sink effect" (i.e., absorption and sometimes re-emission of chemicals from building surfaces) are also being developed. Major new emphasis is also being placed on the development of methods for evaluating a variety of control options, including comparisons of exposure reductions and costs, and methods for determining the effectiveness of air cleaning devices.

On the program side, source assessment and control activities have become focused on initiatives to promote the concept of lower-emitting materials and the identification and filling of gaps in the Agency's efforts to control major indoor pollution sources.

The chamber test method described above figures prominently in a major Agency effort to promote voluntary industry programs to reduce chemical emissions from their products, and is currently being used by the carpet industry to test emissions from carpet, carpet pads, and carpet adhesives. This approach to source control is gaining momentum throughout the country, due in part to VOC control programs being mounted to control ozone in the ambient air, in part to EPA efforts such as the carpet dialogue process now underway, and because of the increasing demand by architects, builders, and consumers for lower-emitting materials. In FY 92, the Indoor Air Division, in cooperation with the Office of Toxic Substances, will expand its source emission characterization work to other indoor air sources to better characterize and rank the range of source emissions. We anticipate that this work will lead to future dialogues with other industries to attempt to identify low cost, low impact approaches to reducing emissions, and thus human exposures, to chemicals and other pollutants.

Perhaps one of the most important initiatives underway in the source control area is the Agency's work on environmental tobacco smoke (ETS). As I indicated earlier, EPA's indoor air program is predicated on taking a balanced, multi-faceted approach to controlling indoor air quality through source control wherever feasible, provision of adequate ventilation, and application of appropriate air cleaning technologies. EPA is addressing a large number of individual sources through its chemical specific programs, and no effective indoor air effort could ignore tobacco smoke as a major source of indoor air pollution. ETS contains a very large number of chemical compounds and is clearly a major source of combustion particles and gases indoors. The acute irritant effects are well documented, and the Surgeon General and the National Research Council both concluded in 1986 that ETS poses longer term health risks as well. As members of the committee are probably aware, EPA has been conducting research on biological markers of exposure to environmental tobacco smoke for some time, and has two major informational documents in preparation on ETS at the present time. The more technical of the two documents is an assessment of respiratory symptoms in children and lung cancer in adults associated with exposure to ETS. The second document is intended for those with responsibility for establishing smoking policies and describes the policy and technical options for control of ETS. Our assessment of the lung cancer risk has been reviewed by the Agency's Science Advisory Board and while they have recommended a number of changes to the document, they appear to be comfortable with the primary conclusion drawn in the report with respect to the association of ETS and lung cancer in non-smokers. We will respond to this advice and anticipate that work on both documents may be completed later this calendar year and that when completed, they will by useful additions to the body of literature available on this indoor air contaminant.

Recommendation #4: A program is needed to develop and promote, in conjunction with appropriate private sector organizations, guidelines covering ventilation, as well as other building design, construction, operation, and maintenance practices for ensuring that indoor air quality is protective of public health.

Until very recently, indoor air quality has been almost exclusively the domain of researchers who have been investigating aspects of the indoor air issue and conveying the results of these scientific investigations to other researchers through journals and other scientific venues. While this scientific process is essential and fundamental, we believe that, before deciding whether it is appropriate to use the more traditional regulatory approaches, that a major Federal effort to attempt to stimulate improvements in building performance through non-regulatory approaches should be attempted. Consequently, much of the current emphasis of the indoor air program at EPA is focused on the development of initial guidance on building design and performance, based on what is technically reasonable at this time. This guidance is designed to *minimize human exposure to the full range of indoor pollutants* by addressing all aspects of building design, construction, operation, maintenance, and occupancy, and is being targeted for architects and design engineers, building owners and operators, new home developers, school management personnel, state and government personnel, and others. On-going research will permit this initial guidance to be updated and expanded in the future.

Our initial guidance development efforts are targeted in 7 areas and are in varying stages of development:

(1) Guidance for owners and operators of public and commercial buildings on the prevention of indoor air quality problems in existing buildings. This guidance is being developed jointly with CDC's NIOSH and in close cooperation with the Building Owners and Managers Associations (BOMA) and is intended to promote *preventative*

indoor air quality management on the part of building managers and occupants so that health and comfort problems are not permitted to develop. The document describes the basic factors affecting indoor air quality in buildings; provides practical approaches to collecting and organizing basic information on the building design, mechanical system operation, and occupant activities in order to identify potential problem areas; describes the elements and steps to developing an indoor air quality management plan; discusses the importance of and mechanisms for effective communications with building occupants; and provides specific information on sources of additional information. While we recognize that the many responsibilities of building owners and managers make a prevention program such as this a hard sell for those with buildings that have few, if any, occupant complaints, we believe that such informed approaches must be encouraged, particularly when they can be cost-effectively employed.

(2) A companion document for the same audience is also under development that takes a problem-solving approach to indoor air quality problems and is intended for building managers and occupants who are facing real or perceived indoor air quality problems and need practical assistance on how to respond. Intended as a "self-help" guide, it is also being prepared jointly with NIOSH and in close consultation with BOMA. This document addresses many of the same issues as the prevention guide, but focuses on the identification of problems, evaluation of control strategies such as source control, ventilation system modifications, and air cleaning. While intended to be usable by in-house staff, the guide also contains a section

describing when outside assistance may be appropriate and how best to obtain such help.

Both the prevention and problem solving guides have already undergone extremely wide reviews by approximately 75 outside organizations, and we anticipate that the documents will be ready for distribution during the latter part of this year.

(3) An introduction for architects and engineers to the principles of indoor air quality and their application in the design, construction, and commissioning phases of new building development is about to be distributed for external review, and we hope to complete the document this calendar year. We intend to coordinate this work closely with related activities being conducted by the American Institute of Architects.

(4) A homebuilders' guide to indoor air quality is being developed which introduces basic concepts of home design that influence indoor air quality, from ventilation aspects to moisture control. It will provide developers with a set of "basic features" which are often already integral to current new home construction practices, as well as some potential "upgrade" features that they may wish to offer prospective buyers who may be particularly interested in minimizing sources and maximizing ventilation, consistent with energy conservation goals. This document has undergone an external review and is now under revision. We anticipate publication later this year.

(5) A guide to smoking policies which I described in some detail earlier.

(6) An introduction to indoor air quality for personnel with responsibility for health and safety issues in school environments. This guide would introduce basic

indoor air quality principles relevant to schools, and is intended to be used in conjunction with the building owners' and managers' prevention and problem-solving guides described above. This document is in the early stages of development.

(7) An introduction to indoor air quality for physicians is being prepared by the American Lung Association under a grant from the Indoor Air Division. This document, which is in its early draft stage, is intended to acquaint physicians with information that will assist them in identifying patient symptoms which may be associated with indoor air exposures, and to help them sort out those which may not be building-related.

All of these guidance documents are being developed with the broadest possible participation by other Agencies and organizations and are intended to represent a consensus in the field on what steps can be taken to minimize people's exposure to indoor air contaminants. As you can imagine, achieving consensus on these complex issues is extremely difficult, and the process is considerably more time consuming that we would like. Nevertheless, we believe these documents will provide important substantive advice to those audiences that have heretofore not had access to such information.

While we believe that such guidance is the most appropriate first step, we are also very interested in the overall issue of ventilation and in helping to ensure that buildings are adequately ventilated to minimize health and comfort problems. The Department of Energy (DOE) is required by law to develop building standards for public and private buildings. These standards address ventilation as a means to improve the quality of indoor air. DOE and the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) have been working cooperatively to develop compatible Federal and consensus standards. ASHRAE has recently updated its Standard 62, Ventilation for Acceptable Indoor Air Quality (Standard 62-1989), which is a consensus standard that prescribes minimum ventilation system design and operating criteria and is intended to achieve the necessary balance between energy conservation and indoor air quality. We believe that the current ASHRAE standard represents a good faith effort to address the many conflicting principles inherent in building design and management, and that on balance it is an improvement over previous standards. At the same time, some limitations of the standard must be acknowledged. The standard prescribes minimum outdoor air supply requirements that are intended to be acceptable, from a comfort standpoint, to 80% of building occupants. While this is also intended to minimize the potential for adverse health effects, it is not, in fact, a health based standard. This is not the fault of ASHRAE or its process, but neither they nor we have the necessary information to establish pollutant levels which can be used with any assurance that significant adverse health effects will be avoided. Thus, it is premature to be thinking that a true health-based ventilation standard can be established anytime in the near future. Nevertheless, it is probably appropriate to begin to evaluate how widely the existing ASHRAE standard is being incorporated into building codes, and the degree of compliance under actual building operation conditions.

Another area of concern to the Agency is the burgeoning growth of indoor air quality diagnostic and mitigation firms and the need for the public to be assured that the services being advertised and provided in this complex field are as advertised. Unfortunately, the field is too young, the range of indoor air quality problems and solutions too numerous, and the scientific uncertainties sufficiently great, that no standardized procedures or guidelines for these firms are feasible at this time. Within the last year, EPA convened a group of more than 60 organizations, representing virtually the entire spectrum of groups concerned about indoor air quality, to explore this very issue. While their consensus was as I just described, the participants agreed that all of the involved professional disciplines need to begin sharing information. Effective indoor air quality building investigations, are by definition, multi-disciplinary in nature. EPA has now expanded this group to over 100 organizations, and has established specific workgroups to explore ways to enhance existing programs for certification of industrial hygienists, engineers, architects, and others; to develop continuing education curricula; and to identify other mechanisms to provide cross-fertilization across the many involved disciplines.

Recommendation #5: A program of technical assistance and information dissemination, similar in scope to the radon program, is needed to inform the public about risks and mitigation strategies, and to assist state and local governments and the private sector in solving indoor air quality problems. Such a program should include an indoor air quality information clearinghouse.

Perhaps the most fundamentally important element of the effort to solve indoor air quality problems is to begin the process of actually transferring the practical information we are developing on indoor air quality problems and solutions to those individuals whose actions directly or indirectly affect indoor air quality. This group, taken at its broadest, includes virtually the entire adult population, encompassing all those that participate in the design, operation or maintenance of buildings, those who are called upon to solve people's health or other problems in the public and private sectors, and the people who occupy buildings, and thus have a role as sources or controllers of indoor air quality.

As a first step , we are beginning to develop regional indoor air program capabilities to assist in information dissemination and to help provide technical assistance to the States, who, along with local agencies, are on the front lines of indoor air quality complaints and problem solving. Two regions have already developed indoor air outreach programs, and in FY 92, each regional office will, for the first time, have a full time indoor air contact and some headquarters support for training and outreach activities. Training these people to understand and be able to respond to indoor air complaints is a top priority. The Indoor Air Division has developed a training course for State and local government personnel, and this course was piloted in January for all of the Agency IAQ contacts along with several dozen

State and local government representatives. We are working with several groups to develop a system for on-going delivery of this course over the next several years. In recognition of the fact that the number of people who can be reached through "live" training is considerably more limited than the number of State and local government people who need to be reached, we are also about to publish, in cooperation with the Public Health Service and the National Environmental Health Association, a "self-paced" training module that contains both introductory information on indoor air quality and appropriate responses to complaints, and an in-depth reference guide of technical information.

This process of training and information transfer has only begun. We are already working on a course for building owners and managers that will be used as part of a major outreach program that will be mounted to promote the use of the EPA/NIOSH self-help guides described earlier. We also anticipate developing major outreach programs around the other guidance documents as they are completed, in an effort to promote real changes in building performance. These outreach programs will involve close cooperation and coordination with all of the agencies and organizations who are interested and involved with aspects of building design and operation as well as source management.

EPA's public information efforts on indoor air are also being expanded. As you may know, EPA and CPSC jointly published a booklet entitled *The Inside Story... A guide to Indoor Air Quality*, in 1988, and approximately 300,000 copies have been distributed through a variety of channels. We are now printing an update of the *State*

Directory of Indoor Air Contacts, prepared in cooperation with the Public Health Foundation, and have published a series of fact sheets on indoor air issues, most recently on the use and care of home humidifiers and on residential air cleaning devices. A more comprehensive companion to the air cleaner fact sheet was also published for those interested in more detailed information on air cleaning devices.

The most important public information initiative under development is a new indoor air quality information clearinghouse. This clearinghouse will provide a central source of information on indoor air quality technical and research information, as well as resources available to State and local governments, building owners and managers, architects and engineers, physicians, and the general public. The technical and non-technical information to be provided through the clearinghouse is now being compiled, and we expect to launch the clearinghouse, which will be accessible to the public through an "800" number, late in FY 92.

Recommendation #6: The Federal government should undertake an effort to characterize the nature and pervasiveness of the health impacts associated with indoor air quality problems in commercial and public buildings, schools, health care facilities, and residences, and develop and promote recommended guidelines for diagnosing and controlling such problems.

As I noted earlier, the lack of information on the scope of building-related problems, and the lack of a complete set of tools for diagnosing problems, is a serious roadblock to future policy development and evaluation efforts. Consequently, in FY 92, the indoor air research and program offices will begin a joint program of building studies designed to accomplish two objectives. First, on the research side, we will be trying to extend the development of scientifically valid diagnostic and testing protocols for the scientific investigation and characterization of public and commercial buildings for use by government agencies and private diagnostic programs. This portion of the program will focus on methods development and validation. Second, on the program side, we will begin to collect data using currently available methods and procedures to begin to compile a database of indoor air quality parameters (including information on specific pollutants, thermal comfort parameters, ventilation performance, and occupant perceptions). This program, which will be carried out in both complaint and non-complaint buildings, will utilize outside investigators and research groups to compile standardized information in a comparable format for an agreed-upon subset of parameters typically looked at in buildings. A major planning effort for this program will be required and will be getting underway later this year.

COORDINATION WITH OTHER FEDERAL AGENCIES AND THE PRIVATE SECTOR

Other Federal agencies have significant indoor air related activities, and several are expanding their involvement in indoor air issues. We believe that indoor air issues are currently well-coordinated with both the public and private sectors and that, while there is always going to be room for improvement, efforts to legislate better coordination will probably fall short of expectations.

As you know, NIOSH has extensive experience in conducting building investigations, and is actively involved in a variety of building studies, research initiatives, and other cooperative ventures, including joint sponsorship with EPA of our guidance documents for building owners and managers on preventing and solving indoor air quality problems in public and commercial buildings which I discussed earlier in my testimony. Similarly, the National Institute of Standards and Technology (NIST) provides valuable expertise in a wide array of indoor air ventilation studies. DOE has numerous research projects underway which test and evaluate methods of ensuring indoor air quality while still maintaining an energy efficient building. In addition, as mentioned previously, DOE is responsible for developing building standards which take into account indoor air quality. OSHA has recently developed guidance for its inspectors on indoor air quality, offers a course on indoor air, and is looking seriously at the issue to determine whether OSHA should promulgate additional standards on workplace air quality. The Consumer Product Safety Commission (CPSC) is in the process of developing a report to Congress on its plans for addressing indoor air quality consumer product issues.

An interagency Committee on Indoor air Quality (CIAQ) serves as one mechanism for coordinating the activities of the Federal agencies on indoor air quality issues, including radon, and meets on a quarterly basis. Although the CIAQ does not have independent budgeting or decision-making authority, it serves as a vehicle for facilitating multi-agency cooperative efforts, for ensuring multi-agency review of documents on indoor air quality and for exchange of information and views on both technical and policy issues. EPA provides funding support for the CIAQ including funds for organization of meetings and yearly publication of a comprehensive directory of *Current Federal Indoor Air Quality Activities.*

One of the many complexities in addressing the indoor air issue effectively is the fact that numerous overlaps in jurisdiction have been created by different legislative authorities. For example, while OSHA has lead regulatory responsibility for occupational safety and health issues and the Consumer Product Safety Commission has lead regulatory responsibility for consumer product issues, Title IV of the Superfund Amendments and Reauthorization Act of 1986 (SARA) gave EPA responsibility to develop a comprehensive indoor air quality research and information dissemination program covering all aspects of indoor air quality. This program must, of necessity, address issues of indoor air sources, which are frequently consumer products, and of the design and operation of public and commercial buildings, for which OSHA also has responsibility for protection of the health and safety of workers in those buildings.

We do not believe that these overlaps can be eliminated by independent Agency initiative, nor do we believe that such overlaps are inherently bad. Rather, they simply point to the need to strive for effective coordination and cooperation across agencies, a level which we believe is being achieved.

Coordination with the private sector is achieved though a variety of mechanisms and is extensive. For example, each of the documents prepared by the program office undergoes an external review in which all outside interests are provided with an opportunity to comment on the documents. Follow-up meetings with key groups, mini-external reviews of subsequent drafts for some documents, and frequent contact with key organizations ensures that the outputs are accurate and fair. In some cases, outside groups have participated in projects from their inception. For example, the Building Owners and Managers Association (BOMA) has been involved in development of the prevention and problem-solving guides from the initial conceptual meeting through each of the many subsequent drafts. Their involvement has been invaluable in ensuring that the documents reflect the realities of building management. We have also entered into contractual and cooperative agreements with several organizations, including the National Association of Homebuilders National Research Center, the American Lung Association, and the National Environmental Health Association to conduct projects of mutual interest. As a result of these efforts, we consider the documents prepared on indoor air quality to represent a consensus in the community on appropriate building performance and source management, based on what we know at this time.

LEGISLATIVE INITIATIVES

As you know, two bills have been introduced in the Congress which are intended, among other things, to enhance the Federal government's response to the indoor air quality issue. Versions of these bills have been introduced since the 100th Congress, and last year, the Senate passed S.657. This year, S. 455 has been introduced by Senators Mitchell and Chafee, and is identical to the one which passed the Senate during the last Congress. In the House, Congressman Kennedy has introduced H.R. 1066, a variation of the Senate bill, but with some significant differences. I would like to take a few minutes to comment on these bills, and to perhaps suggest to you a direction which we think would be a more fruitful one to accomplish what I believe are our mutually shared goals in the indoor air field.

Both the Senate and the House bills would direct the Federal government to conduct a series of specific activities to expand the research and information dissemination programs now underway. Both bills contain a large number of provisions which in principle are consistent with the approach which we have undertaken. Given this similarity in approach, and the many relative risk reports ranking indoor air as a very high environmental health risk, I know that it has been difficult for some to understand the Administration's opposition to new legislation which, on the surface, appears to be a helpful push in the right direction. Unfortunately, we find that in their totality, both these bills are unnecessary and, in some cases, detrimental.

Of concern to EPA are sections of the proposed bills that may detract from Agency efforts to concentrate its indoor air resources in areas with the most strategic potential for reducing human exposures to indoor air pollutants, i.e., the building performance strategy I outlined for you earlier. Unfortunately, despite the good faith efforts of many in the Congress to craft a reasonable bill, we have become convinced that both of the two pending bills will diminish opportunities for near term progress by diverting resources to a painstaking and narrow focus on specific pollutants rather than the problem as a whole. In addition, both bills will force us to spend too much time preparing reports and studies to be read by government staff and researchers, instead of devoting our energies to reaching and educating the people with direct influence over the indoor environment.

Examples of our concerns in this regard are those provisions which would have the indoor air program focus on individual pollutants, such as the health advisory provisions of Section 7 of H.R. 1066 and the product labeling provision in Section 16. The problems with these sections, from our perspective, are twofold.

First, no significant new health research findings can be anticipated during the three years allowed for health advisory or labeling requirements development.

The contaminants listed in the Senate bill (benzene, biological contaminants, carbon monoxide, environmental tobacco smoke, formaldehyde, lead, methylene chloride, nitrogen oxide, particulate matter, asbestos, polycyclic aromatic hydrocarbons (PAHs), and radon) are, with the exception of biological contaminants, among those on which the agency has been conducting research and, in many cases, risk management activity for several years. The identification of these particular contaminants in the bill presumably reflected Congressional desire that the Agency move quickly to provide information, without need for substantial additional research, and the list in fact is a reasonably accurate reflection of those indoor air pollutants about which we do know the most. The efficiency of this approach, however, is also its weakness in that it would result in the Agency simply repackaging existing information into a new format, without adding to the public's real knowledge about the risks of exposure to these contaminants and appropriate control technologies. The fact of the matter is that many of the most significant health issues revolve around what effects may be associated with exposure to very low levels of chemicals, either singly, or, in combination. The science gap between what we know about health effects of individual compounds at relatively low exposure levels and what we would like to know is, as I noted earlier, significant, and will take many years and substantial resources to begin to understand.

Second, both of these provisions will drain substantial resources without productive gain.

We are quite concerned that development of health advisories even on a list of contaminants about which our knowledge base is relatively strong would not be a straightforward process but would require substantial re-review, an extended process of comment and response, and considerable resource expenditures. We expect that the advisories could, quite unintentionally, become the focal point of the indoor air program's activities rather than the complementary information program envisioned by its drafters. Frankly, the FY 92 President's budget would enable us to address the full range of indoor air quality issues rather than a small subset, and not get mired down in old controversies or even new pollutant specific issues which are most appropriately dealt with in other program areas and for which the Agency already has adequate statutory authorities.

This concern is magnified in the product labeling provision. Except for a number of pollutants and sources which have been or are the subject of regulatory or other action or scrutiny, we have very limited information that would provide a basis for believing that the majority of commonly used and available consumer products actually "pose a significant adverse human health threat through indoor air contaminant emissions." Nor do we have any desire to cause undue alarm over the indoor air issue. However, where scientific justification is available, the Federal government has very powerful statutes at its disposal (e.g., TSCA, FIFRA, CPSA, OSHA) to control such risks, and we are committed to using them. As I indicated earlier, we are striving to improve our utilization of these statutes. However, we do not believe that the bills that have been introduced would enhance our ability to address pollutant-specific risks.

SUMMARY

I am proud of the work of our indoor air quality team in developing a comprehensive, informative approach to indoor environmental quality. This approach has involved, from the outset, broad consultation and collaboration among private and public sector experts. I very much appreciate this opportunity to discuss with you our progress in developing an effective response to indoor air pollution. As this subcommittee continues to work on possible legislative approaches to indoor air quality, I urge you to focus your energies and ours on improving all aspects of building performance, including ventilation and source management, and permit our existing chemical-specific program to address those chemical-specific risks which we both agree must be aggressively identified and controlled. We will be very happy to work constructively with this subcommittee as your work in this area progresses.

* * *

Mr. **Scheuer**. Thank you, Dr. Shapiro.

Now we will hear from Eric Peterson, executive director of the Consumer Product Safety Commission.

Mr. Peterson.

Mr. **Peterson**. Good morning, Congressman.

I am pleased to appear before this committee to discuss the important topic of indoor air quality. I am accompanied this morning by Sandra Eberle, the Commission's principal expert on indoor air quality.

Mr. Chairman, your letter inviting the Commission to testify on H.R. 1066, the Indoor Air Quality Act of 1991, asked specifically for the Commission's views on section 16, contaminant emission product labeling. This section directs CPSC to assist EPA in establishing standards for measurement of emissions and identification of products that pose health threats.

I note for the committee that the views presented here are those of the staff and do not necessarily reflect the official position of the U.S. Consumer Product Safety Commission.

The Commission staff recommends that the provisions of section 16 be removed from the proposed legislation. The section conflicts with the Commission's authority to require labeling on consumer products which advise consumers of significant health hazards under the Federal Hazardous Substances Act.

The Commission staff believes section 16 will not provide consumers with either correct or adequate information to protect themselves from products which pose a significant adverse human health threat. The labeling provisions of section 16 are extraordinarily complex and difficult to implement and would complicate the work of the Commission which it has either completed or has in process.

Since 1973, the Commission has administered the provisions of the FHSA. Under the provisions of this act, the Commission requires labeling for household products that are hazardous substances. On April 17 of this year, the Commission published in the Federal Register proposed guidelines and definitions which provide guidance concerning the definition of toxic chronic hazards such as cancer, sterility, birth defects, harm to developing fetuses, and/or damage to the nervous system.

The Commission already has in place regulations specifying tests that may be used to determine whether a product is acutely toxic by ingestion, inhalation, and skin contact, and guidelines for determining when a substance can cause allergenic sensitization.

The proposed guidelines clarify when a product presents a risk of chronic toxicity. The Commission's proposed supplemental definition of toxic defines a consumer product which presents a greater risk than one in a million as toxic. This includes the risk from indoor air exposure to hazardous substances in the home.

These proposed guidelines will complete a comprehensive system for evaluating the hazards of a substance, the amount and kind of exposure to consumers, including exposure through indoor air of their homes, and the health risk.

The provisions of the FHSA are sufficient to require manufacturers to provide this information to the public without the Federal Government spending years of effort and millions of dollars in test method development. If the Congress concludes that additional enhancements of consumer product labeling are necessary to address issues beyond emissions which present a potential health hazard, the Commission is ready to work with you on the specifics.

Requiring labeling of indoor air contaminant emission rates will not provide consumers with either correct or adequate information to protect themselves from products which pose a significant adverse human health threat. An emission rate is not required by FHSA labeling regulations and may only confuse consumers.

Consumer products, especially the solvent-containing liquid products referred to in section 16, have complex formulations of multiple chemicals. These products may present multiple hazards. They may be flammable. They may be highly poisonous to children if ingested, or they may cause skin or eye irritation. The utility of the product is often a function of the hazardous chemicals it contains. The risk to a consumer depends upon the emission rate and on the toxic potency of the ingredients and the conditions of use. These conditions are not reflected by an emission rate. A more useful comparison for the consumer is one based on the overall safety of the product. To decide whether the product can be used safely or whether the risk of using a product is acceptable, the consumer needs to know the exposure and risk to human members of the household as a result of using the product. The labeling provisions of the FHSA already make this information available to the consumer.

Finally, the Consumer Product Safety Improvement Act of 1990, which reauthorized the Commission, requires the Commission to report to Congress later this month on its indoor air quality activities. A copy of the report will be sent to this committee as soon as it is complete. The report gives many of the details of Commission activities associated with indoor air emissions.

Ms. Eberle and I are available to answer any questions you may have.

[The prepared statement of Mr. Peterson follows:]

U.S. CONSUMER PRODUCT SAFETY COMMISSION
WASHINGTON, D.C. 20207

TESTIMONY OF

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EXECUTIVE DIRECTOR
U.S. CONSUMER PRODUCT SAFETY COMMISSION
SUBCOMMITTEE ON ENVIRONMENT
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U.S. HOUSE OF REPRESENTATIVES
WASHINGTON, D.C.
MAY 9, 1991

Good Morning, I am pleased to appear before this Committee to discuss the important topic of indoor air quality. I am accompanied this morning by Sandra Eberle, the Commission's principal expert on indoor air quality.

Chairman Scheuer's letter inviting me to testify on H.R. 1066, the "Indoor Air Quality Act of 1991," asked specifically for my views on section 16, "Contaminant Emissions Product Labeling," which directs CPSC to assist EPA in establishing standards for measurement of emissions and identification of products that pose a health threat. The letter asks that the testimony address the potential effectiveness of this provision in protecting the public from the threat of indoor air contamination and the applicability of the approach outlined in section 16 for liquid products, such as those containing solvents.

The provisions of section 16 would require the Administrator of the Environmental Protection Agency, in cooperation with the Consumer Product Safety Commission, to establish testing methods and labeling requirements for chemical emissions from consumer products that pose a significant health hazard. Section 16(b) speaks of

> Regulations requiring that products which pose a significant adverse human health threat bear a label, or be accompanied by written material, informing consumers and commercial purchasers . . . of the indoor air contaminant emission rate of such products.

The Commission staff recommends that the provisions of section 16 be removed from the current proposed legislation for the following reasons. The Federal Hazardous Substances Act (FHSA), administered by the Commission as one of the transferred acts since the Commission's establishment in 1973, requires labeling provisions which are adequate to advise consumers of significant health hazards. Requiring labeling "of the indoor air contaminant emission rate" will not provide consumers with either correct or adequate information to protect themselves from "products which pose a significant adverse human health threat." The labeling provisions of section 16 would be extraordinarily complex and difficult to implement. The provisions of section 16(a)(2) require

> the Administrator (of EPA) . . at a minimum (to) assess the indoor air contaminant emission threat from pressed wood products, including particleboard, plywood, and medium density fiberboard; floor coverings; combustion appliances, including gas stoves, gas dryers, and kerosene and unvented gas space heaters; products containing solvents;

> and unvented gas space heaters; products containing solvents;

This would duplicate work which the Commission has either completed or has in process.

Since 1973, the Commission has administered the provisions of the FHSA. Under the provisions of the FHSA, the Commission requires labeling for household products that are "hazardous substances." The FHSA defines a "hazardous substance" as

> any substance or mixture of substances which (i) is toxic, (ii) is corrosive, (iii) is an irritant, (iv) is a strong sensitizer . . . if such substance or mixture of substances may cause substantial personal injury or substantial illness during or as a proximate result of any customary or reasonably foreseeable handling or use. 15 U.S.C. § 1261(f)(1)(A).

The term "toxic" is defined as

> any substance . . . which has the capacity to produce personal injury or illness to man through ingestion, inhalation, or absorption through any body surface. 15 U.S.C. § 1261(g).

On April 17, 1991, the Commission published in the Federal Register proposed guidelines and definitions which provide guidance concerning the definition of "toxic" with respect to chronic hazards, such as cancer, sterility, birth defects, harm to the developing fetus, or damage to the nervous system. The proposed guidelines describe test methods which can be used to provide information about indoor air exposures. The Commission already has in place regulations specifying tests that may be used to determine whether a product is acutely toxic by ingestion, inhalation, and skin contact and guidelines for determining when a substance can cause allergic sensitization.

The proposed guidelines would clarify when a product presents a risk of chronic toxicity. The Commission's proposed supplemental definition of toxic would define a consumer product which presents a risk greater than one-in-a-million as "toxic." This would include the risk from indoor air exposures to hazardous substances in the home.

The FHSA requires hazardous substances to be labeled with:

> (1) The name of the chemical or chemicals that present the hazard;
>
> (2) The nature of the hazard, such as harmful to unborn children, causes cancer;

(4) Direction that the product is not to be used by children, and

(5) First aid instructions.

15 U.S.C. § 1261(p).

These proposed guidelines will complete a comprehensive system for evaluating the hazard of a substance, the amount and kind of exposure to consumers - including exposure through the indoor air of their homes - and the health risk.

The provisions of the FHSA are sufficient to require manufacturers to provide this information to the public, without the Federal government spending years of effort and millions of dollars in test method development.

If the Congress concludes that additional enhancements of consumer product labeling are necessary to address issues beyond emissions which present a potential health hazard, the Commission is ready to work with you on the specifics.

Requiring labeling "of the indoor air contaminant emission rate" will not provide consumers with either correct or adequate information to protect themselves from "products which pose a significant adverse human health threat." An emission "rate" is not required by FHSA labeling regulations and may confuse consumers. Consumer products, especially the solvent containing liquid products referred to in section 16, have complex formulations of multiple chemicals. Often the products present multiple hazards: they are flammable, they may be highly poisonous to children if ingested, or they may be skin or eye irritants. The utility of the product is often a function of the hazardous chemicals it contains.

The risk to a consumer depends not only on the emission rate, but on the toxic potency of the ingredients and the conditions of use. For example, a product labeled with a low emission rate may actually be more hazardous than one with a higher emission rate if the ingredients are more toxic or may be emitted for a longer period of time. A consumer will use a large or small amount of the product, depending on how effectively the product performs. A product with a high emission rate of a low toxicity solvent, might be much less hazardous than a product with a lower emission rate of a high toxicity chemical. Whether the consumer uses the product under conditions of good or poor ventilation, high or low temperature, or for varying lengths of time, are all conditions that would greatly affect exposure and risk. These conditions are not reflected by an emission rate.

A more useful comparison for the consumer is one based on the overall safety of the product. To decide whether the product can be used safely or whether the risk of using the product is acceptable, the consumer needs to know the exposure and risk to household members as a result of using the product. The labeling provisions of the FHSA already make this information available to the consumer.

The labeling and testing provisions of section 16 would be extraordinarily complex and difficult to implement. No one method is sufficient for measuring vapor emissions from solvent-containing products. Many different test methods would need to be developed, and the solvents of concern (alcohol, chlorinated hydrocarbons, etc.) would have to be identified. The emission rates of many solvent-containing products would have to be determined individually.

The provisions of section 16(a)(2) affecting consumer products such as pressed wood products, floor coverings, combustion appliances, and products containing solvents will duplicate work which the Commission has either completed or has in process.

The Consumer Product Safety Improvement Act of 1990, which reauthorized the Consumer Product Safety Commission, requires the Commission to report to the Congress later this month on its indoor air quality activities. The report is required to contain:

> a discussion of the nature of indoor air quality hazards and their association with consumer products;
>
> the remedial measures, to the extent known, which may be taken to reduce such hazards;
>
> descriptions of past and current activities of the Commission in the area of indoor air quality;
>
> future activities planned by the Commission to address indoor air quality problems already identified; and
>
> the Commission's overall strategies and plans for identifying and remedying the hazards.

A copy of the report will be sent to the Committee as soon as it is completed. The report gives many of the details of Commission activities associated with the indoor air contaminant emission threat from the products referred to above.

Ms. Eberle and I are available to answer any questions you may have.

Mr. Scheuer. Thank you very much.

We are going to suspend for about 10 minutes while we answer this roll call vote.

[Recess.]

Mr. Scheuer. All right. We will now hear from Ms. Cynthia Douglass, deputy assistant secretary for OSHA, the Occupational Safety and Health Administration, here in Washington.

Please proceed, Ms. Douglass.

Ms. Douglass. Thank you very much. I very much appreciate the opportunity to testify before this committee regarding indoor air quality.

OSHA has a very important role in the Federal efforts to ensure good indoor air quality for Americans. Under the Occupational Safety and Health Act, OSHA has responsibility for worker safety and health, and that extends to virtually all workplaces.

We are authorized to promulgate regulations, to inspect workplaces, enforce our regulations, provide employers and employees with training, education, informational materials, and consultative services. We have used all of these tools to address a range of indoor air quality issues.

The term "indoor air quality" can refer to a wide range of workers' exposures—for example, exposures to air contaminants in industrial settings such as lead and benzene, or exposures to air contaminants in office buildings, which might include environmental tobacco smoke or biological contaminants. The more serious the problem, the more comprehensive the approach we are likely to take.

For example, we have issued extensive regulations and undertaken rigorous enforcement measures to assure that workers who are exposed to harmful levels of benzene fumes or asbestos dust are protected. We have permissible exposure limits, respirator requirements, protective clothing requirements, and other controls. For the well established, serious hazards which occur in industrial settings, we do have extensive regulations. We have permissible exposure limits for 625 air contaminants, including most of the substances mentioned in H.R. 1066. For 25 of those substances, we have also promulgated broad standards which require such measures as engineering controls, medical surveillance, and employee training.

We update these standards periodically and are, in fact, in the process of updating the permissible exposure limits for air contaminants for the agricultural, maritime, and construction sectors. In particular, you may be interested in knowing that OSHA is proceeding expeditiously to update our regulations for lead in construction. We have also recently issued a pamphlet for workers and employers detailing safe work practices and other precautions in lead-based paint removal.

OSHA also has specific ventilation standards which are applicable to certain industries and processes, such as abrasive blasting. There is no specific OSHA ventilation standard for general industry. However, we do require employers to protect their employees from the airborne contaminants in their workplaces by using engineering controls which would include ventilation systems. When engineering controls are not feasible or sufficient to reduce the concentration of contaminants, OSHA mandates the use of respirators to protect employees from exposure to these substances.

Indoor air quality in nonindustrial settings—that is, in office buildings—has been more difficult to address. OSHA has authority to regulate employers' activities to ensure a healthful workplace when there is a significant risk of material impairment of health and there is a technically and economically feasible solution. We are not authorized under the act to regulate for comfort unless we can show that the working condition could cause a material impairment of health.

Under the OSH Act, OSHA relies on other agencies, such as EPA and NIOSH, or on the private sector for research and technical support for a rule. OSHA may begin a rule-making when it is petitioned by a party or when reliable technical information to support a rule comes to our attention. We have not received a petition for rule-making on indoor air quality, nor have EPA or NIOSH recommended that we issue a regulatory proposal at this particular time.

With regard to indoor air quality and tobacco smoke, OSHA has drafted and will publish shortly a Federal Register notice which will ask the public for all available information on indoor air quality issues such as health effects, the performance of ventilation standards—ventilation systems, building maintenance programs in use, and hazards of specific contaminants, such as environmental tobacco smoke and radon. It will also ask whether additional controls are needed and the technical and economical feasibility of various options for regulating.

The notice will set a time frame for comments, and then OSHA will evaluate the comments. Following that, OSHA will have a record that will enable OSHA to determine how best to proceed with ventilation, smoking, radon, and general indoor air quality issues.

In addition to our regulatory initiatives, OSHA provides training for Federal and State inspectors at our training institute in Illinois. A training course on indoor air quality was developed in coordination with NIOSH and EPA and covers subjects such as local building codes, health effects of indoor air pollutants, ventilation concepts for office buildings, and strategies for investigating indoor air complaints. The course is offered twice a year and is open to the private sector. In the past two years, we have trained over 158 Federal and State compliance officers as well as personnel from other agencies and several from the private sector.

OSHA inspectors also provide technical support—are also provided with technical support on indoor air quality. Our technical support staff have developed a technical manual on nonindustrial indoor air quality inspections. Again, this manual was developed in conjunction with EPA and NIOSH.

OSHA's Health Response Team in Salt Lake City provides industrial hygiene expertise and support in cases of special health hazards or emergencies. The team is currently preparing a videotape on how to conduct an indoor air quality investigation. This tape will be used by OSHA's training institute and will be available to the public.

OSHA is actively working with other Federal agencies to address the indoor air quality problem. In particular, we work closely with research agencies, such as NIOSH and EPA. NIOSH, for example, notifies OSHA of its health hazard evaluations at workplaces and supports our regulatory, enforcement, training, and other indoor air quality activities.

OSHA is an active member of the Interagency Committee on Indoor Air Quality which coordinates the efforts of the Federal Government. We are also involved in a number of other interagency committees that are addressing specific contaminants, such as asbestos, lead, and gases from carpets.

Many agencies have a role in various aspects of indoor air quality, including OSHA, EPA, Health and Human Services, the Department of Energy, the Consumer Product Safety Commission, and the General Services Administration. We all want to carry out our responsibilities.

You have asked for OSHA's comments on H.R. 1066, particularly sections 15 and 17. In general, we believe that OSHA has sufficient authority to issue standards for indoor air pollutants in the workplace. We are in the process of requesting information from the public to determine whether a specific standard for indoor air should be developed. Information from NIOSH, EPA, and others with expertise in this area will be actively sought and considered during the decision-making process. Thus, we believe that OSHA is achieving the goals of section 17.

With respect to section 15, it specifies penalties for OSHA to enforce that are different from those contained in the OSH Act. Penalty requirements that are different from those contained in our act would confuse employers and would impede OSHA's ability to enforce provisions of H.R. 1066 in an efficient manner, plus we feel that we already have the authority to issue these regulations.

In conclusion, we believe that OSHA does have sufficient authority to protect workers from indoor air hazards. OSHA appreciates the opportunity to work with this committee, and my colleague, Chuck Atkins, who is the director of our Office of Health Compliance, and I are both available to answer your questions.

Thank you very much.

[The prepared statement of Ms. Douglass follows:]

STATEMENT OF
CYNTHIA DOUGLASS
DEPUTY ASSISTANT SECRETARY OF LABOR FOR OCCUPATIONAL SAFETY AND HEALTH
U.S. DEPARTMENT OF LABOR
BEFORE THE
SUBCOMMITTEE ON ENVIRONMENT
COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES

May 9, 1991

Mr. Chairman and Members of the Subcommittee:

Thank you for this opportunity to discuss H.R. 1066, The "Indoor Air Quality Act of 1991." To place my comments on the bill in perspective, I would first like to describe the efforts of the Occupational Safety and Health Administration (OSHA) to protect America's workers from the hazards of indoor air pollution.

OSHA currently has statutory authority to address indoor air quality issues in the workplace. Under the Occupational Safety and Health Act of 1970 (OSH Act), OSHA is responsible for administering a national program to assure a safe and healthful workplace for approximately 85 million workers in some 6.5 million workplaces. OSHA's authority extends to virtually all private sector employers regardless of the nature of the work or the worksite. The OSH Act authorizes the agency to assist employers in removing workplace hazards by offering training, education, and consultative services. OSHA also promulgates safety and health standards and conducts inspections to enforce those standards. The OSH Act allows States that wish to operate their own occupational safety and health programs to do so. Twenty-three states and jurisdictions administer comprehensive OSHA programs, and two other States operate OSHA programs for their public employees only.

It is an elementary principle that the quality of the air which workers breathe is essential to a safe and healthful workplace. "Indoor Air" can refer to workers' exposure to a range of issues from hazardous chemicals in an industrial setting to inadequate ventilation in an office building. The more hazardous and well established the problem, the more extensive OSHA's regulations and enforcement are likely to be. OSHA is examining indoor air pollution in a comprehensive way and is utilizing the full range of its programs to address the problems. Indoor air pollutants range from known and well-defined hazards such as lead and benzene to less well-known potential hazards such as carpet off-gassing and bacterial hazards. The agency's broad expertise in engineering and industrial hygiene is being used to identify and eliminate indoor air pollutants from the workplace. We are working closely with the Environmental Protection Agency (EPA), the National Institute for Occupational Safety and Health (NIOSH), and others to address a wide range of indoor air pollutant concerns.

Standards

Under the OSH Act, OSHA has authority to regulate employers' activities to ensure a healthful workplace when there is a significant risk of material impairment of health and the solution is technically and economically feasible. We are not authorized to regulate for comfort unless we can show that the working condition could cause a material impairment of health. For research and technical support for a rule, under the OSH Act OSHA must rely on other agencies such as EPA and NIOSH or on the private sector. OSHA may begin a rulemaking when it is petitioned by a party or when reliable technical information to support a rule comes to its attention. We have not received a petition for rulemaking on indoor air quality nor have EPA or NIOSH recommended that we issue a regulatory proposal. Action on Smoking and Health (ASH) petitioned OSHA in May 1987 for an emergency temporary standard on tobacco smoke which OSHA denied in September 1989. The issue is currently in the courts. The burden on OSHA to justify issuance of an emergency temporary standard is greater than for a normal rulemaking, and we do not believe that the burden of proof for an emergency temporary standard can be met.

OSHA has a number of regulations in place that can be used to address many aspects of indoor air quality. The agency has established permissible exposure limits for more than 600 air contaminants, including substances such as acetic acid, chlorine, carbon monoxide, and nitrogen oxide, which are prominent indoor air contaminants. OSHA updated the permissible exposure limits for many of these contaminants in 1989 in order to increase worker protection.

For 25 of these toxic substances, OSHA has also issued comprehensive standards that specify additional protective measures such as engineering controls, personal protective equipment, work practices, workplace monitoring, medical surveillance and training. The comprehensive standards address substances such as asbestos, benzene, formaldehyde, lead and coal tar pitch volatiles, many of which are sources of indoor air pollution that are listed in H. R. 1066.

OSHA also has ventilation standards applicable to a number of industries. In industrial settings with large concentrations of pollutants, OSHA requires personal protective equipment such as respirators when engineering controls cannot be used. Ventilation regulations are important because the National Institute for Occupational Safety and Health (NIOSH), which conducts research, has found inadequate ventilation in more than half of all the indoor air quality investigations it has conducted in the past decade. The ventilation requirements mandate that employers use engineering controls, such as exhaust systems, wherever feasible.

Another regulation that enhances indoor air protection for employees is OSHA's Hazard Communication Standard. The standard requires that employers provide employees with information about the hazards of the chemical substances used in their workplaces. It also requires that training and education be provided to workers so that they can take precautions to minimize the hazards. The standard applies to _all_ workplaces, including office buildings, where employees may be exposed to hazardous chemicals. Instead of being restricted to specific substances, the regulation addresses a half million or more hazardous substances--all those used in America's workplaces. OSHA's enforcement of the standard is designed to ensure that workers know of the dangers from these substances.

As we learn more about the problem of controlling workers' exposure to indoor air pollutants, OSHA may determine that a specific standard is necessary to address this problem. OSHA is now preparing a Federal Register Notice which will ask for all available information on indoor air quality issues such as health effects, the performance of ventilation systems, building maintenance programs in use, and the hazards of specific contaminants such as environmental tobacco smoke and radon. It will also ask whether current regulations are sufficiently protective and what additional controls or activities may be needed.

Enforcement

OSHA conducts inspections from eighty-five offices located throughout the Nation. The agency enforces its standards (a) through programmed, or self-initiated, inspections, most of which are targeted to high-hazard industries, and (b) through inspections in response to worker complaints, reports of accidents, or referrals from Federal and State agencies. Last Fall OSHA issued a compliance directive to all field offices setting forth specific procedures for conducting indoor air inspections. At that time the agency also added a new chapter on indoor air to its Technical Manual, which is the agency's guide for conducting health inspections.

When OSHA's compliance officers arrive at the workplace to examine possible indoor air problems, they first seek information from both employers and employees concerning the extent of any illnesses or discomfort suffered in the work environment. The compliance officer examines the design and operation of the heating, air conditioning, and ventilation systems. The officer also looks at the kind of machinery that is operating in the workplace and the frequency of its use and maintenance. In addition, OSHA examines employers' policies on smoking in the workplace. During an inspection, OSHA normally conducts monitoring for air contaminants in the workplace. OSHA's Analytical Laboratory in Salt Lake City has advanced equipment to perform air contaminant analyses, tests, and studies. These studies determine the toxicity of substances and their possible health effects at the measured levels. The Laboratory has also validated a number of sampling procedures that can determine employees' exposure to low concentrations of toxic materials such as those which may be found indoors. During or following the inspection, OSHA may make recommendations to the employer concerning ways to improve ventilation efficiency, treat the air to remove contaminants, or change work practices to minimize employee exposure.

OSHA's Health Response Team, located in Salt Lake City, is another source of assistance on indoor air. The Health Response Team provides industrial hygiene expertise and support in cases of special health hazards or emergencies. The Team is equipped with specialized sampling equipment such as that used for indoor air microbiological contamination evaluations. The Team responds to requests for assistance in evaluation of indoor air quality in Federal and State buildings as well as in private sector workplaces. The Health Response Team is currently preparing a videotape on how to conduct an indoor air quality investigation; this tape will be used by OSHA's Training Institute in its indoor air instruction.

In order to ensure that OSHA's Compliance Officers are knowledgeable about the variety of indoor air hazards which they may find at the workplaces they inspect, OSHA's Training Institute, which instructs Federal and State inspectors, provides training and instruction on indoor air quality. The training which compliance officers receive was developed in coordination with NIOSH and EPA and covers subjects such as local building codes, health effects of indoor air pollutants, ventilation concepts for office buildings, and strategies for investigating indoor air complaints. The course is offered at the Training Institute twice a year and is open to the private sector.

Voluntary Compliance

OSHA encourages compliance with its regulations through a variety of methods in addition to the enforcement program. For instance, OSHA's field offices offer technical assistance on occupational safety and health to employers and employees. There is written information available to the public at OSHA's Area Offices.

OSHA's consultation service is a state-run program, with 90-percent Federal funding, which provides assistance on all aspects of occupational safety and health. The consultants will provide advice either at the employer's establishment or off site. Priority for consultative visits is given to small-business employers in high-hazard industries. Consultants with expertise in occupational health are available to help employers find ways of eliminating hazards associated with indoor air contaminants.

Interagency Activities

The health impact of indoor air pollution is a problem that demands the attention of more than a single Federal agency. We are actively working with other agencies to address this problem. OSHA is a member of the Interagency Committee on Indoor Air Quality, which coordinates the efforts of the Federal Government. Through the Committee, we review research and guidance documents developed by other agencies and present for their review products which OSHA has developed. In addition, we are involved in a number of other interagency committees that are addressing specific contaminants such as asbestos, lead, and gases from carpets. Many agencies have a role in various aspects of indoor air quality including OSHA, EPA, Health and Human Services, the Department of Energy, Consumer Product Safety Commission, and General Services Administration. I look forward to continuing our work on indoor air in order to ensure that Americans are working in a healthful environment.

Comments on H.R. 1066

You requested, that OSHA comment on sections 15 and 17 on H.R. 1066. Section 15 deals with ventilation standards for public and commercial buildings. The provisions of this section require that all newly constructed or renovated buildings maintain heating and air conditioning systems, meet specified standards, and maintain appropriate records on the design and operation of the systems. Existing public and commercial buildings would be required to have heating and air conditioning systems that meet local building codes. EPA is given one year to establish standards to implement these requirements. OSHA is required to enforce the regulations, and penalties for violations are specified in the bill.

OSHA opposes enactment of this provision for several reasons. First, it divides standards-setting and enforcement authority between EPA and OSHA, requiring OSHA to enforce EPA's regulations. This is inadvisable since it would interfere with OSHA's broad statutory authority to protect workers. Under section 6 of the OSH Act, OSHA is given responsibility for issuing standards dealing with toxic substances or harmful physical agents. OSHA's mandate is to protect the working people of this nation from all hazards, whether they are found in buildings or in other work environments. OSHA, in developing standards, already works closely with EPA, the National Institute for Standards and Technology, and NIOSH to incorporate their research and advice. In fact, EPA and OSHA signed a Memorandum of Understanding last year to coordinate their enforcement efforts.

Section 15 of H.R. 1066 also specifies penalties for OSHA to enforce that are different than those contained in section 17 of the OSH Act. For example, H.R. 1066 subjects those who "knowingly" violate section 15 to a civil penalty not to exceed $5000 per violation. Under the OSH Act, as amended by the Omnibus Budget Reconciliation Act of 1990, an employer who "willfully" violates a standard may be assessed a penalty of up to $70,000 per violation and must be assessed a penalty no lower than $5000 for each willful violation. Penalty requirements that are different from those contained in the OSH Act would confuse employers and would impede OSHA's ability to enforce provisions of H.R. 1066 in an efficient manner.

Section 17 deals with indoor air quality protection in the workplace. The Secretary of Labor, working in cooperation with EPA and NIOSH, is to evaluate evidence to determine whether standards on indoor air quality are necessary. The evaluation must be done within 180 days of enactment. If a standard is deemed necessary, the Secretary must issue a final rule within 2 years after enactment of the bill. Section 17 sets forth six broad provisions which must be included in the standard.

As was stated earlier in this testimony, OSHA already has sufficient statutory authority to issue standards for indoor air pollutants in the workplace and has issued regulations for over 600 specific air contaminants. We are also in the process of asking the public for information to determine whether a specific standard for indoor air should developed. Information from NIOSH, EPA, and others with expertise in this area will be considered during the decision-making process. Thus OSHA is already achieving administratively the goals of section 17. The agency should retain the flexibility provided under section 6 of the OSH Act to determine: (1) the circumstances under which it is necessary to develop a new standard, (2) the priority which this rule should be given in relation to other hazards that must be addressed by OSHA, (3) the time-table for the rule, and (4) the contents of the regulation. A forced time-table could stymie important research and information gathering on this complex problem.

In conclusion, we believe that OSHA has sufficient statutory authority to protect workers from indoor air hazards. We believe that the proposed legislation could create confusing statutory overlaps between the concerned agencies and would likely divert agency resources from ongoing efforts in this area. For these reasons, we oppose legislation at this time.

I would be pleased to answer any questions.

Mr. SCHEUER. Well, thank you very much, Ms. Douglass. We appreciate your fine testimony. You do really sound as if you have enthusiasm and commitment in your own way—I mean your own agency's way—to making the goals of our act a reality.

Ms. DOUGLASS. I think we do have enthusiasm and commitment, and we are trying to make the goals a reality.

Mr. SCHEUER. Well, we appreciate that, and we appreciate your general attitude and constructive approach.

We will now hear from Mr. John Millhone, deputy assistant secretary for building technologies of the Department of Energy.

Let me say, Mr. Millhone, I think your Secretary is one of the stars of this administration in Washington, and he tried very, very hard to put together a splendid national energy policy, and it is strange and sad what happened to that policy on the way from your agency to 1600 Pennsylvania Avenue.

Please proceed, Mr. Millhone.

Mr. MILLHONE. Thank you for your kind comments, Mr. Chairman. We are struggling with reality, too.

Mr. SCHEUER. Yes. We are all struggling with reality.

Mr. MILLHONE. It's a pleasure to have the opportunity to talk to you about the Department's indoor air quality program. I certainly commend the sponsors' concern for the quality of indoor air in the Nation's buildings. The Department has had a long-standing and continued interest in this area, going back to the mid-seventies. We conduct about $12 million of research annually in different topics related to indoor air. This includes basic research on health effects, it includes work associated with making buildings more energy efficient, and it also includes, through the Bonneville Power and Western Area Power Administrations, major regional energy delivery programs.

I am going to focus my comments on the sections that are new in this legislation. Section 15, dealing with ventilation standards for public and commercial buildings, would mandate a ventilation rate of 20 cubic feet per minute per person for all public and commercial buildings with a high of 60 CFM if smoking is allowed. This is of particular interest to the Department of Energy because of our statutory responsibility of developing design building energy standards for new Federal buildings and recommended standards for non-Federal buildings.

As part of the standards that determine the energy efficiency of a new building, there is a reference to the ventilation standards that is required because of the relationship between the amount of ventilation and conditioned air associated with the design of the building itself.

We work very closely with other agencies, with the private industry, through the American Society of Heating, Refrigerating, and Air Conditioning Engineers, in developing an industry consensus standard for what this ventilation level should be. We believe that that process is far superior to that which would be imposed by the legislation. Let me give you some examples.

There is continuing research in this area that looks not only at the air changes but also the different functions within buildings. For example, in the ASHRAE Standard 62, you have different CFM requirements for different kinds of functions ranging from 10 to 20 to 50 for public rest rooms and for locker rooms. The legislation would say that for all commercial buildings this should be 20 CFM instead of this different level of standard based upon the function of the buildings.

The current standard provides that methods of air filtration, local exhaust, and zoning strategies can be used as part of the air management system for a building. That flexibility would not be allowed in the standard. There is a method of providing for compliance based upon the indoor air quality procedure which looks at the level of contaminants, and that also would not be allowed.

Over the course of time, the change in CFM reflects the latest research, and this has indicated—as an example of this, the 1981 standard provided for 5 CFM per person. Additional research showed that that was too low, that it wasn't adequately providing fresh outside air, and, as a result of research that the Department of Energy conducted, we found that you could increase that from 5 to 20 and that the energy penalty would be 5 percent, which was significant but not so significant that you shouldn't move in that direction to have a healthier indoor environment. So DOE supported the change made by others so that the current standard is 15 and 20 as the level that would take the place of the previous 5 CFM.

So that kind of flexibility over time is the appropriate method of dealing with this issue through the best of the scientific and technical experience both in Government and industry, and that kind of flexibility that industry consensus process would be preempted by legislation in this area. We feel that that would be a mistake.

In the other areas considered in this new amendment—that is, dealing with labeling of products and indoor air quality protection—the unfortunate situation is that we just don't have the level of research necessary to understand these areas sufficiently to be able to pass regulations and accomplish the Congress's and the Nation's goal in that fashion. It is better to do the kind of support that Congress is providing and that the agencies have indicated an interest in through Government-industry collaboration to come with issues, for example, on how you measure in a test chamber the pollutants that are controlled in a carpet sample, and take that information, and then apply it to the level of pollutant within an entire building. There is work that is being done in this area with CPSC, with EPA, with DOE, and with the carpet industry, and it is that kind of research that can lead to the advances in this area through that approach rather than through the mandating of labels ahead of the time that can be accomplished successfully as a result of ongoing research.

In general, we feel, as the chairman said at the outset, that the positive benefits of good air quality ought to be emphasized. If we can accomplish a 1 percent improvement in the worker productivity as a result of having fresher air, there will be a $20 billion improvement in the Nation's output, and playing on the importance of Government-industry working together to improve the quality of indoor air is a more positive approach than one that requires additional regulation.

Thank you, sir.

[The prepared statement of Mr. Millhone follows:]

Statement of John P. Millhone
Deputy Assistant Secretary for Building Technologies
Office of Conservation and Renewable Energy
U.S. Department of Energy

Committee on Space, Science and Technology
Subcommittee on the Environment
U.S. House of Representatives

Thursday, May 9, 1991

Mr. Chairman and members of the Committee, I am pleased to have the opportunity to provide the Department of Energy's views on H.R. 1066, the Indoor Air Quality Act of 1991. The Department has had a longstanding and continuing interest in indoor air quality and has conducted an active program of research in this area in coordination with other agencies for more than a decade.

In the interest of time, I would like to submit for the record a brief written description of the current DOE activities that relate to indoor air quality. I will focus my remarks on H.R. 1066 and, in particular, the three new provisions: Section 15, Ventilation Standards for Public or Commercial Buildings; Section 16, Contaminant Emissions Product Labeling; and Section 17, Workplace Indoor Air Quality Protection.

The Department shares the sponsors' concern for the quality of the indoor air in the Nation's buildings. We have been sponsoring research in this area since the mid-1970s, focusing on building design and operating strategies that enhance both energy efficiency and a healthy indoor environment.

However, as you may know, the Department has opposed previous versions of this bill. Specifically, DOE joined the Environmental Protection Agency and the

Department of Labor in an Oct. 11, 1990, letter to Congressman Dingell opposing H.R. 5155. In that letter, which I would also like to submit for the record, we said that the legislation would provide no useful additional authority to address indoor air quality issues, but rather would impose on top of the evolving successful Federal effort a substantial number of mandatory actions and deadlines. Such requirements would be largely nonproductive and serve to redirect the current effort into repackaging existing information and preparing numerous reports and plans. The many specific interagency interactions mandated by the bill, rather than assisting in sorting out overlaps in jurisdiction, as intended, would serve only to further blur lines of responsibility. These views apply similarly to H.R. 1066.

We are particularly concerned that the legislation fails to recognize the Department's longstanding and continuing indoor air quality research activities. These activities are described more fully in a bibliography of the indoor environment program at DOE's Lawrence Berkeley Laboratory. I would be pleased to provide a copy for the record.

For example, the Office of Building Technologies has supported research on indoor air quality, infiltration, and ventilation as part of our ongoing research program on building energy efficiency. The research has also supported the development of building energy standards and guidelines under the Energy Conservation in New Buildings Act. These standards are the product of many years of internal development and external coordination with building trade and standards groups. The result of the DOE research is incorporated into the voluntary industry consensus ventilation standards promulgated by the

American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE). DOE personnel and laboratory researchers participate actively in this consensus process.

DOE is currently focusing on the relationship between indoor air quality and occupant perception, supporting a multidisciplinary research effort to determine the path toward healthy buildings. This effort, entitled the "California Healthy Buildings Study," is a long-range project involving the DOE-supported Indoor Environment Program at Lawrence Berkeley Laboratory and the California Department of Health Services. Through the development of scientifically valid experimentation, the project's plans are to develop a defensible set of recommendations for designing and maintaining healthy and productive environments in commercial buildings.

Additional information on recent DOE activities is contained in the March 1991 publication, "Radon Research Program FY 1990" and in "Current Federal Indoor Air Quality Activities." These publications and many others from the DOE radon program are available if the information would be helpful. More than 20 technical reports on indoor air quality are also available from the Bonneville Power Administration.

Now let me turn to the three new sections of the proposed legislation.

Section 15. Ventilation Standards for Public or Commercial Buildings. This section would mandate a ventilation rate of 20 cubic feet per minute (cfm) per person for all public and commercial buildings (60 cfm per person if smoking is allowed). To mandate a single ventilation rate for all public and commercial buildings would be of questionable value and would disrupt DOE's development of energy efficiency standards for the design of new buildings. These DOE standards are mandatory for new Federal buildings. Although voluntary for non-Federal buildings, they are intended as models for local and State building codes. The ventilation requirements are an essential part of the building standards.

The current method of developing ventilation standards is working and has been effective in addressing the emerging concerns for indoor air quality. DOE researchers have been working closely with researchers from other Federal agencies, States, and private industry to develop a consensus standard for ventilation. The participants represent both the environmental health and energy fields. As noted earlier, ASHRAE provides the framework for this consensus process. The result is the ASHRAE Standard 62, "Ventilation for Acceptable Air Quality," which is incorporated by reference into the DOE building standards.

The ASHRAE ventilation standard includes many more ventilation specifications for various different types of building spaces than does H.R. 1066 and provides the designer with some important technical options. Air filtration, local exhaust, and zoning strategies are air management options allowed by the standard. In addition, the standard allows for compliance based on an alternative method, called the "Indoor Air Quality Procedure." This procedure requires a demonstration to show that the pollutant levels are below specified concentrations, based on accepted health effects information. This approach allows flexibility while still protecting the health of the building occupants. The consensus standard is revised regularly in response to the latest results of research on ventilation, indoor air quality, and human health effects.

Section 16. Contaminant Emissions Product Labeling. This section seeks to provide architects, builders, and others with information regarding products brought into the workplace or home. The Administrator of EPA is directed to assess the indoor air contaminant emission threat from "pressed wood products, including particleboard, plywood, and medium density fiberboard; floor coverings; combustion appliances, including gas stoves, gas dryers, and kerosene and unvented gas space heaters; products containing solvents; and pesticides." Within some of these categories, there are hundreds of commercial products, each with different and frequently changing chemical compositions. The Administrator is then directed to determine which products pose a significant adverse human health threat, which would then be required to bear a label, informing consumers and commercial purchasers of their contaminant emission rates. The approach assumes a level of understanding about the sources and effects of indoor air pollutants that doesn't exist.

For some products, where pollutants have been clearly identified, such as formaldehyde and combustion products, manufacturers and building designers have already taken actions to reduce human risks, out of concerns for liability as well as adverse health effects. However, the sources of other concerns, such as those associated with "sick building syndrome," are not as clear or certain. The level of emissions will vary based upon the age of the product, temperature and humidity, and air infiltration and ventilation. Individual sensitivity varies greatly, depending not only on the level of a single pollutant, but possibly also on the effect of mixtures of pollutants, and other environmental sensitivities and stresses. Emissions product labeling simply does not adequately solve the problem and may be counterproductive.

The section conveys the idea that the Federal government can solve the Nation's indoor air quality problems simply by labeling pollution sources so that they will be avoided in the future. Unfortunately, the solution is not that simple. The real solution will require Federal, State, and industry efforts to conduct the RD&D necessary to increase our understanding of indoor air quality and the practical steps that can be taken to improve it.

Section 17. Workplace Indoor Air Quality Protection. This section would direct the Secretary of Labor to determine whether standards on workplace indoor air quality are necessary to protect the health and safety of employees. If he determines standards are necessary, the Secretary is directed to issue workplace standards that include permissible exposure limits to provide protection from cumulative, synergistic, and combination effects for indoor air contaminants present in workplace indoor air.

As was true for the labeling provision, this section assumes that the causes of indoor air quality problems are simpler and better known than they are. An enormous amount of resources could be expended to try to determine the permissible exposure limits to provide protection from the cumulative, synergistic, and combination effects of contaminants. These resources could be far better spent in Federal, State, and industry efforts to identify the practical steps that can be taken to improve the quality of indoor air.

Both Sections 16 and 17 take a regulatory approach to improving indoor air quality. The Department is opposed to using a regulatory approach which would not be effective and would delude the Congress and the public into thinking a serious problem was being solved, when, in fact, it would not be.

We believe the most effective approach to improving the indoor air quality of the Nation's buildings is not by regulation, but by increasing the awareness of the energy and productivity benefits of a healthier indoor environment and the understanding of how to achieve it. Productivity gains in office workers due to improved air quality can result in substantial benefits. A 1% increase in U.S. office workers' productivity due to improved indoor air quality would have a value of $20 billion a year. A cooperative public and private effort to identify how to achieve these healthy, comfortable, and productive environments can accomplish far more than new Federal regulations. For these reasons, we oppose H.R. 1066.

I appreciate your time and attention, and I would be pleased at this time to answer any questions that you may have. Thank you very much.

Mr. **Scheuer**. Thank you very much.

I would now like to recognize my colleague, Tim Valentine of North Carolina, if you have a statement.

Mr. **Valentine**. Mr. Chairman, I don't have a statement. I appreciate the opportunity to sit with the subcommittee, and I want to express to you my appreciation for focusing attention on these problems, but I don't have any statement. Thank you, sir.

Mr. **Scheuer**. Okay.

Dick Swett of New Hampshire, do you have any opening statement?

Mr. **Swett**. Thank you, Mr. Chairman. I have a brief opening statement which I am perfectly willing to just submit for the record, if I have your unanimous consent.

Mr. **Scheuer**. Outstanding. You certainly have unanimous consent.

[The prepared statement of Mr. Swett follows:]

Congressman Dick Swett
May 9, 1991

OPENING STATEMENT

Thank you, Mr. Chairman. This is a truly important issue, and one that has not received the attention it deserves. So I am glad that you have called this important hearing.

I will be brief with my opening statement this morning since I am looking forward to hearing the testimony of our distinguished witnesses. But I wanted to state that I support the goals of this bill very strongly. Contamination of the air we breathe indoors is a real threat to our health.

One major concern, though, that I hope our witnesses will address themselves to today, is how to implement the goals of this program without drastically increasing our energy use. I believe efforts to conserve energy and to improve the quality of indoor air are not mutually exclusive. I hope today's witnesses will be able to discuss this issue and tell me what affect this bill will have on our energy conservation initiatives.

Mr. Chairman, I am looking forward to an interesting and productive hearing. Thank you for this time and I yield back what remains of it.

Mr. SCHEUER. Now my colleague from New Jersey, Mr. Zimmer. Do you have an opening statement?

Mr. ZIMMER. I have no formal opening statement. I'm just delighted that the Committee is pursuing its work on indoor air pollution.

I testified before this subcommittee in 1986 in my capacity as the chairman of the National Council for Clean Indoor Air. I'm sure you vividly remember that testimony.

Mr. SCHEUER. It's indelibly printed in my memory.

Mr. ZIMMER. And, as a Member of the New Jersey State Legislature, I've been deeply involved in this issue. It's one reason that I sought assignment to this Subcommittee. So, I'm looking forward to our work.

Mr. SCHEUER. We value you and your background and experience very much on this subcommittee.

All right. Now for some questions.

John Millhone, before we get started on the questions before us today emanating from H.R. 1066, do you—can you bring your background in sick buildings—analysis and so forth—to the West Springfield High School that we have been reading so much and hearing so much about in Fairfax? What is it all about? What does that stem from? What kind of ailments, what conjuries of ailments are those young people suffering from, and what should we be doing about it? Very briefly, please. And the reason I ask is, because I haven't heard any word from any competent, specialized, Federal, State, or city government agency that would shed some light on what is going on out there.

Mr. MILLHONE. Mr. Chairman, we have not looked at the research results that have been undertaken there, so I can't comment with any specificity.

We have looked at similar problems that have been reported in other buildings where we have undertaken some analysis, and the difficulty for a public agency like the Department of Energy or even the State or local health officials is that the best science can sometimes be used to try to understand what has happened there that has caused that kind of effect, and we have been unable to determine a measurable indoor air quality source for those kinds of problems.

Now that doesn't mean to say that there isn't an indoor air quality problem that is there, it is just that the measurement technologies that we have, using the best science that is available, hasn't been able to identify what that correlation is between indoor air and the health effects.

Mr. SCHEUER. Do you have any doubt that with hundreds of those young people fainting, becoming desperately ill, all kinds of ailments—headaches, nausea, and the like—that there is a problem in that school?

Mr. MILLHONE. From the accounts that I have seen, sir, it certainly looks as if there is a problem in that school, and that shows the need for continued and enhanced research efforts to understand this problem more thoroughly.

Mr. SCHEUER. Would you not be able to suggest anything they can do about it, any remedial efforts they could undertake?

Mr. **Millhone**. We could have the best scientists that we have in the national laboratories review what has been done so far to see if they have recommendations for additional tests or possible causes of the problem that haven't been thought of by those people who are working on that directly.

Mr. **Scheuer**. Okay.

Mr. Shapiro—Dr. Shapiro, it seems clear to me that the Congressional view and your view of adequate resources for this problem do not match up at all. Why is so little money directed toward this major health threat which, in aggregate, is greater than all other sources of outdoor air pollution combined, including toxic dump sites?

Dr. **Shapiro**. Well, again, this is a relatively new area of concern for the agency.

Mr. **Scheuer**. Well, it's not so new, Dr. Shapiro. I'm trying to keep these questions short and fast. We first started—Claudine Schneider and I had hearings and had a bill in 1983. Now that is eight years ago. That is a lot of time. I think we had a proposal for either two or three million dollars to research it, and EPA opposed that; they didn't want to know. Now if you don't want to know, then, of course, you are in a position where you are not under pressure to take remedial action, no matter how bad the problem is. You can always say you don't know because you never tried to know.

Why are you still fighting funding to accrue basic knowledge of this problem?

Dr. **Shapiro**. I don't think we are. We have doubled our research budget in the last year. We have grown our program budget in the indoor air area by a factor of 10. In addition to that, you have to—

Mr. **Scheuer**. Well, I mean let's compare your budget for indoor air pollution to your budget for outdoor air pollution and toxic dump sites, for example. How do they stack up?

Dr. **Shapiro**. Well, if you add in the money we are spending on—

Mr. **Scheuer**. I mean ten times zero is still zero.

Dr. **Shapiro**. If you add the money that we are spending on radon annually, on asbestos with our indoor air program, I think our outdoor air program is still by a factor of 2 larger, but they are much more comparable. I can't compare directly the Superfund budget.

Mr. **Scheuer**. All right.

Dr. Peterson, the Federal Hazardous Substances Act, in addressing irritants, has limited action to causes of irritation involving "substantial personal injury or illness." These symptoms cause an alarming loss in productivity. By the time that they meet your criteria for regulation, however, wouldn't a great deal of unnecessary suffering and health costs have been incurred before they hit your trigger level?

Dr. **Peterson**. Mr. Chairman, the trigger level is one that is established by regulation, which is largely set by Congress.

Mr. **Scheuer**. Well, would you recommend that we change that threshold and reduce it so that it does include unusual and aggravated discomfort, let us say? The substantial personal injury or illness seems a very high threshold level.

Dr. **Peterson.** If the Congress would be interested in working with us to be able to quantify that in some fashion that is both supportable in the courts as well as supportable in congressional deliberation, we would be very pleased to work with you, sir.

Mr. **Scheuer.** Ms. Douglass, you oppose section 17, the workplace standards provision, since you believe that OSHA has all the authority it needs. In the next panel, a representative of the AFL-CIO will testify that your record on indoor air quality, however great your commitment and your enthusiasm, but the record of your agency, let me say, is so abysmal that Congress needs to strengthen this provision.

Now, how is it that the constituency that you were charged with protecting has come to have so little faith in the efforts which you applaud in your testimony, you as an individual? You seem to have great qualities of commitment and leadership, but in terms of what the agency is doing, they don't seem to inspire faith and confidence in the very constituency that you are trying to protect. How come?

Ms. **Douglass.** Well, I think that over the last—I think that over the last couple of years that we have greatly increased our efforts in the indoor air quality area, and I think that that will be turning around, that impression with the AFL-CIO and others.

We think that we do have a good program and a good plan in place right now. I think that we have worked with a number of agencies on the development of our technical support manual for inspection purposes, and we have worked with those agencies on our training at the training institute, and those programs, those are in place now, and I don't believe—I believe those have received very good reviews from everybody, including our constituency.

Now, with respect to the regulatory area, I think we are doing—doing well in the industrial setting, although obviously we are continually updating the standards based on new information that we receive.

Now, as I was saying, in the nonindustrial setting we do have more of a problem. We do have to show a significant risk of material impairment of health, and we are working with EPA and NIOSH and others to try to pull that information together and see where we need to be going, and we have a draft Federal Register notice that is in the clearance process right now, and we expect to be able to issue that shortly, and I think we are on track to getting that information. I am more than happy to sit down and talk about, you know, what further effort they would like to see us undertake.

Mr. **Scheuer.** Let me ask you and perhaps John Millhone, what are you doing to protect the teachers at this West Springfield School? That is their workplace, and the kids seem to be dropping like flies.

Ms. **Douglass.** Okay. That is—I said that we have jurisdiction over virtually all workplaces, but the public school system is one that we do not have jurisdiction over under the OSHA Act.

Mr. **Scheuer.** Okay. Let's forget technical jurisdiction. What would you do if you had jurisdiction? What would you do if you were the superintendent of schools out there to look after and assure the health of the teaching staff?

Ms. **Douglass**. I think you send a team of knowledgeable experts out to look at the variety of elements that would go into determining how to proceed, and OSHA has expertise in that area, EPA, and the Health and Human Services' NIOSH does health hazard evaluations, and we all have industrial hygienists and experts in this area and experts in the ventilation systems, and I would look—I would send a team of experts out to look at that.

Mr. **Scheuer**. Do you know if that has been done?

Ms. **Douglass**. I don't know if that has been done because OSHA does not have the authority to do it, and we haven't been asked.

Mr. **Scheuer**. Does anybody else on the panel know if a team of experts has been assembled?

Dr. **Peterson**. Mr. Chairman, CPSC has offered its services to the school system and to the county health department. At this point, we are awaiting the reports and analysis that were done by the consultants hired by the school system.

Mr. **Scheuer**. And they haven't taken up your—

Dr. **Peterson**. We haven't received those reports yet.

Mr. **Scheuer**. Okay. You have made the gesture.

Mr. Millhone, could you tell us briefly—could you summarize the funding levels over the past decade for indoor air quality work, exclusive of radon, that has been carried out by the Lawrence Berkeley Labs?

Mr. **Millhone**. Mr. Chairman, I would like to provide those details for the record. In general, the work at Lawrence Berkeley Laboratory was started in the mid-seventies. The level of funding rose fairly rapidly at that period of time into the range of two to two and a half million dollars. It was decreased during the 1980's into the range of about a million and a half dollars and has stayed in that vicinity since that time.

Mr. **Scheuer**. Wouldn't you say that two to two and a half million dollars going down to less than two million dollars, if this constitutes the major thrust of the Federal effort, that that is a rather pathetic figure for an area of pollution creating illness, serious illness, that is greater than all sources of outdoor air pollution put together, as I mentioned before? Isn't that a pitiful level of effort?

Mr. **Millhone**. Mr. Chairman, I should add that in describing the activity, the funding at Lawrence Berkeley Laboratory, that is only a portion of the Department's research in this area. There is also in the area of health effects, looking primarily at radiation and radon, a level of funding of about $10 million. Even so, I believe your comments regarding the level of funding certainly should be regarded seriously by the Department.

Mr. **Scheuer**. Thank you.

Congressman Zimmer of New Jersey.

Mr. **Zimmer**. Thank you.

To follow up on that point about funding, I would note that this Committee—Subcommittee's bill for EPA research funding for indoor air would double again from $6.8 to $14 million. So, this Subcommittee is concerned about funding for research. But, on top of that, I am concerned that the three new sections that appeared in H.R. 1066 this year might require major funding increases in themselves. I don't see anywhere in the bill where the money is provided for, in an authorization.

Could all of you give me any relevant information on this issue, addressing the potential costs of the new sections?

Dr. **Shapiro**. With respect to EPA's responsibilities, we have not had a chance to assess what additional costs it would take to implement those portions of the bill that we would have responsibility for. It would clearly be a significant increase above the resources that we currently have in place.

Mr. **Zimmer**. If there were not additional money authorized and appropriated, where would the money come from for the regulatory provisions under the EPA responsibilities?

Dr. **Shapiro**. Judgments would have to be made during budget processes to essentially where the priorities were within the agency and, therefore, where the resources would have to go.

Mr. **Zimmer**. Does anyone else on the panel have a dollar estimate?

Ms. **Douglass**. I don't have a dollar estimate for you, but I can say that our—with OSHA, we feel that with section 15 and 17, both, that we have the authority in those sections to adopt regulations, and, again, it is a matter of priorities, how you prioritize your budget. If you add additional monies for that, it probably can happen a little faster, although I'm not even sure, actually, it could happen faster, because it depends on research, and there is an administrative procedures process that we would need to go through.

But, again, it is a matter of setting your priorities and determining your use of resources within the agency. So it's hard to say whether or not we would seek additional resources for those provisions; we may not.

Mr. **Zimmer**. Mr. Peterson.

Dr. **Peterson**. The Commission's perspective would be that there would be no need for additional resource expenditures in that we are already very active in this area and have essentially completed, or will complete very soon, the comprehensive system to address these issues from the Commission's perspective.

Mr. **Zimmer**. And, you have enough resources to comply with the three new sections as they currently appear?

Dr. **Peterson**. Well, we are complying. We believe that we are in full compliance with the requirements of section 16 in that those are already being executed under the Federal Hazardous Substances Act. I am not, frankly, prepared at this point to address the other two sections, but I would be happy to provide that for the record.

[The information follows:]

Comments on Section 15 of the Bill

Section 15 deals with ventilation standards for non-industrial and non-residential buildings. Consequently, it is not clear whether schools and residential or special use buildings would be covered. Under the Consumer Product Safety Act, the Commission has jurisdiction over consumer products used in schools, in recreation, or otherwise. Section 15 would provide for a nationwide ventilation standard. The Commission believes such a national standard may worsen the quality of indoor air rather than improving it because local needs and different building needs will not be considered. For example, air of a poorer quality than the air inside might be brought into a building in Southern California during a bad smog time. In Wisconsin, during January, there may be serious problems with bringing in air which is 30 degrees below zero. Setting performance standards rather than design standards would solve this problem. If the standard required indoor air of a certain quality, achieving this quality could be achieved by recirculating scrubbed indoor air rather than bringing in outside air.

The Commission thinks that section 15 would be stronger if it called for the development of indoor air quality performance specifications within a reasonable time period. These specifications should be developed by a consolidated government team effort organized and coordinated by the Committee on Indoor Air Quality (CIAQ) which includes the Consumer Product Safety Commission, the Environmental Protection Agency, the Occupational Safety and Health Administration, the Department of Housing and Urban Development and the Department of Energy. The Government team can provide leadership to the private sector, including the model building code organizations and voluntary standards groups. The Commission has worked successfully to have safety devices included by building code groups. Two outstanding examples are requirements for ground fault circuit interrupters and fencing and gate requirements around swimming pools. The additional advantage of working with building code groups is that localities have the opportunity to participate and ensure that requirements meet their individual needs.

Comments on Section 17 of the Bill

Section 17 deals with workplace indoor air quality protection. Although it is necessary to improve standards in the workplace, the Commission questions the merit of selecting only one segment of the population for protection. The provisions of section 17 consider neither total exposure, and thus total risk, nor the merit of providing different levels of protection for workers and other members of society.

Mr. **Zimmer**. Thank you.

Mr. Millhone.

Mr. **Millhone**. I would just make the comment that the Department's concern is not so much with the funding requirements of these sections, although there would be considerable, but with the belief that the direction of the funding would not go where the money could be most effectively spent.

Mr. **Zimmer**. You indicate, in your testimony, that it might be most effectively spent on research, I guess. What sorts of research would you like to see pursued? Or, if you think it would be better spent on other priorities, I'd like to know that, too.

Mr. **Millhone**. I believe that the need here is to advance the understanding of some of these problems. Let me expand on the example which I gave earlier.

There is what is called a carpet dialogue that involves the industry and the agencies, including CPSC and EPA, that are concerned with that issue. One of the topics that is getting attention right now is the development of an agreed upon methodology of transferring the results of chamber studies into real room pollutant conditions, and that is not a simple issue because it's not a simple matter of scale-up. You have to look at the different surface to ratio volume in a small test chamber, you have to look at the different movement patterns in such a chamber and correlate that kind of information into a variety of different room configurations, and once you accomplish that type of activity, then you can have a uniform procedure that Government and industry researchers can use to measure the level of VOC's or other pollutants in a—and get some kind of correlation between health effects and the measurements within a test chamber. It's that kind of research that is sort of nuts and bolts; it's the stuff that needs to be done before you can really accurately come up with information from a carpet sample into health effects, and it is the extension of that kind of research that is most critical at this time.

Mr. **Zimmer**. Dr. Peterson, I would like to follow up, for a moment, on what you said about Section 16. In your testimony, you had said that emission information would not be very useful, and you just said that you consider yourself in full compliance with the requirements of Section 16. I assume you aren't, and you don't want to be in full compliance with the emission disclosures.

Dr. **Peterson**. Well, our perspective is that it is not the emission rate that is the critical factor, it is the question of toxicity as it is regulated under the Federal Hazardous Substances Act, and to interject this issue of emissions rates as a labeling requirement, for example, only causes to confuse the consumer and to essentially raise a smoke screen over the real issue that we believe is at the heart of the indoor quality debate.

Mr. **Zimmer**. To get back to my original question, how much would it cost if you were to comply with this emission rate disclosure requirement?

Dr. **Peterson**. At this point, we just wouldn't have any hard and fast figures on it, but we, quite frankly, don't see the need to even address the emission rate issue.

Mr. **Zimmer**. I understand that. What I am trying to get to is, I'm trying to get a dollar price tag for these proposals, and I fully understand that you think it is a lousy idea. But, I would like to know how much it would cost to implement this idea.

Dr. Peterson. I would be happy to have the staff cost that out for you, sir.

[The information follows:]

Cost of Implementing Section 16 Requirements

The cost of implementing section 16 would be $127,600,000 and six full time equivalents (FTEs). Section 16(a) would require regulations to be issued which:

> (1) establish standard methods for the measurement, and description in appropriate scientific units, of indoor air contaminant emissions; and
>
> (2) identify products that pose a significant adverse human health threat through indoor air contaminant emissions.

The Commission's staff estimates that there are 5,000 separate consumer product formulations and product models. It would require a contract of about $200,000 to develop the list of products required by section 16(a). Two full-time staff members would be needed to identify and supervise a qualified contractor and analyze the data collected.

Test method development is estimated at $300,000 per test method. At least eight separate methods would need to be developed. Four full time staff would be required to monitor the development, under contract, of these test methods over the two-year period.

Testing of each of the estimated 5,000 separate formulations and product models would cost approximately $125 million, based on $25,000 per product. Where more than one "toxic" substance is in a product, the emission rate for each must be tested for separately. This would cost another $25,000 for each additional "toxic" substance found in a product.

The Commission is concerned that the limits set under section 17 will influence acceptable exposure limits which will affect consumer health and safety. The Commission believes that there is a need for uniform risk analysis and criteria on which to base acceptable levels of exposure.

The Commission believes that exposure standards should be developed by a consolidated team effort which could be organized and coordinated by the CIAQ to ensure that the standards would consider the jurisdictions, laws and regulations of the participating agencies.

Mr. Zimmer. Is there any additional labeling that you feel would be useful, other than emission rates, that could give the consumer information about the dangers of products that might cause indoor air pollution, once we get the necessary research accomplished?

Dr. Peterson. Well, as I outlined in my testimony, there are a number of other factors aside from emission rates which have an impact on the toxicity or the harmful effect that a particular chemical or household product may have with the consumer. And those are issues which we have addressed substantially. Those that we have not addressed totally to our satisfaction we are in the process of addressing now and hope to have those guidelines put into place very shortly.

Mr. Zimmer. And, what specific additional information will the consumer get then?

Dr. Peterson. Well, we would look at the issues of the toxicity of the chemicals involved in the product, the use vis-a-vis ventilation, temperature, exposure, protection that the individual should take in using the product—those sorts of things.

Mr. Zimmer. Thank you.

Thank you, Mr. Chairman.

Mr. Scheuer. I thank you.

Congressman Swett of New Hampshire.

Mr. Swett. Thank you, Mr. Chairman.

I have only two areas that I would like to make inquiry into, and I'll start one with a little anecdote similar to the school situation that has been talked about in testimony so far and the questions by the chairman. There is a school, an elementary school, in New Hampshire, in my district in Concord, called Beaverbrook Elementary School which has just recently been built, within the last two to five years—very modern, very beautiful structure—is about to be closed down because of poor indoor air quality issues.

The irony in this is that Arnold Schwarznegger was just at the school within the last week promoting health issues as the President's representative in this area, and the school was actually scheduled, prior to their decision to close it, to host Schwarznegger's visit, and they maintained the school in an operating condition beyond the recommended time just so that they could have this press release done there, and I find that very ironic.

My professional background is that as an architect, and what I want to address is, how are we allowing these brand new buildings to be constructed that still have the problems? And I think that the issues that I would like you to address is, in my mind it is not so much a standard problem as it is an enforcement problem, and beyond enforcement I think research and development is important to understand what products have what problems, but you have to let the design community and the construction community know which products can be used and what combination of products can be used in order to avoid any kind of reactions or difficulty within the design itself that otherwise might foster a toxic situation.

What is the procedure, the current thinking, in the OSHA—I guess is where I would like to start with Ms. Douglass—as to how this might be overcome so that not only we are looking at an expense with old buildings, but let's not make new buildings that don't work as well, and how is that being accomplished, Ms. Douglass?

Ms. DOUGLASS. OSHA has put together a technical support manual which I will give you a copy of—I have one copy with me—and I believe that we have tried to address some of the areas that you are talking about, specifically with regard to ventilation, in that manual.

We are also working, through our training institute, to determine how it is best to proceed in this ventilation area in terms of the enforcement area. We are working very closely with EPA, who is also working on developing some guidance to office building owners and also to architects, and we'll be working very closely on that.

We don't have all the answers yet in OSHA. We just don't have all the answers.

Mr. SWETT. If I can interject, my frustration is—and I try to bring my professional experience to my work here in Congress, because I feel that that is a very necessary and useful connection. In the 10 years that I was in the profession, both as an architect, and I have had extensive dealings with EPA as a developer of alternative energy and cogeneration power plants, I've dealt with heavy industry, and I've dealt with large commercial situations in design.

I was never once contacted by OSHA or the EPA, it was always I seeking their advice, and I think that there is a circumstance or situation in the professional world whereby, if you don't know and you are not pressed to know or you are not included in the loop by the agencies, you are not going to employ that technology or that standard, and these are the concerns that I have, that the agencies have not taken an aggressive proactive position on the kinds of things that need to be done to avoid these kinds of closures.

Ms. DOUGLASS. Well, what you are talking about is exactly what we are trying to do in this Federal Register notice that we are, hopefully, issuing very shortly, and in that notice we will be seeking the public's comments on all these various aspects that are very important to determining how to proceed in a regulatory sense and also to helping nail down some of the precise things that you were just asking us to try to nail down.

So, hopefully, through that process we will get the comments from people with knowledge in this area. We are working with EPA and NIOSH on this as well.

Mr. SWETT. I applaud your recognition of that direction and appreciate your doing it now, if not before, and I yield my time back to the chair.

Thank you.

Mr. SCHEUER. Thank you.

Congresswoman Connie Morella.

Mrs. MORELLA. Thank you very much.

[The prepared statement of Mrs. Morella follows:]

INDOOR AIR QUALITY ACT OF 1991
CONGRESSWOMAN CONNIE MORELLA
MAY 9, 1991

Constance Morella

MR. CHAIRMAN, MOST PEOPLE SPEND THE GREATER PART OF EACH DAY INDOORS, AND THE AIR THEY BREATHE INDOORS CAN BE HARMFUL. IT IS MILDLY IRRITATING TO MANY OF US. TO SOME PEOPLE, TOXINS, CHEMICALS AND BUILDING MATERIALS ARE A SEVERE HEALTH RISK. THESE "CHEMICALLY SENSITIVE" PEOPLE ARE HINDERED FROM WORKING IN AN ENVIRONMENT THAT HAS A HIGH CONCENTRATION OF AIR CONTAMINANTS. THE BILL THAT IS THE SUBJECT OF TODAY'S HEARING, THE INDOOR AIR QUALITY ACT OF 1991, HAS A DIRECT IMPACT ON ALL OUR LIVES. I AM LOOKING FORWARD TO A THOROUGH REVIEW OF THE THREE NEW SECTIONS OF THE BILL, SECTIONS 15, 16, 17.

SUPPORT THE CONCEPT THAT THE FEDERAL GOVERNMENT MUST DO MORE TO REDUCE THE HUMAN HEALTH THREAT FROM EXPOSURE TO INDOOR AIR CONTAMINANTS. I HAVE HEARD FIRST HAND FROM EPA EMPLOYEES OF THE HEALTH PROBLEMS THEY EXPERIENCE AT WATERSIDE MALL. WE CANNOT EXPECT PEOPLE TO WORK EFFECTIVELY IN AN UNHEALTHY ENVIRONMENT.

THIS SUBCOMMITTEE HAS HELD SEVERAL HEARINGS ON THE TOPIC OF INDOOR AIR QUALITY, AND IT REPORTED THE INDOOR AIR QUALITY ACT OF 1990 TO THE FULL COMMITTEE IN THE 101ST CONGRESS. EPA HAS CONTINUED RESEARCH ON THE HEALTH EFFECTS OF INDOOR AIR QUALITY, AND IT HAS IMPLEMENTED SOME RESTRICTIONS UNDER THE TOXIC SUBSTANCES CONTROL ACT, FIFRA, AND THE SAFE DRINKING WATER ACT.

MR. CHAIRMAN, THERE IS NO QUESTION THAT INDOOR AIR QUALITY IS A PROBLEM AND THAT THE FEDERAL GOVERNMENT HAS A CRITICAL ROLE TO PLAY IN CONTINUING TO FIND SOLUTIONS TO IT. I LOOK FORWARD TO HEARING FROM OUR WITNESSES AS TO THE MOST EFFECTIVE ROLE THE FEDERAL GOVERNMENT CAN TAKE IN FINDING SOLUTIONS. WHERE SHOULD WE PUT OUR LIMITED RESOURCES IN FIGHTING INDOOR AIR POLLUTION? I AM SURE OUR WITNESSES HAVE THOUGHTFUL COMMENTS TO MAKE ON THE FEDERAL GOVERNMENT'S ROLE. I APPRECIATE THE OPPORTUNITY TO HEAR FROM THEM.

Mrs. MORELLA. Thank you for appearing on this first panel, and you do know what happens in Congress. We all have about four Committees meeting simultaneously and, in many instances, Subcommittees of the same major Committees, which is the case this morning.

Ten sixty-six. It really sounds like my history of England. Wasn't it the Battle of Hastings, and that is when it all began—the Angles and the Saxons. And, now, we are trying to shed some fresh air on this whole picture of indoor air quality, something we all care about. Indeed, my constituents do.

Dr. Peterson, do you live in Bethesda? Is that where Consumer Product Safety has an office?

Dr. PETERSON. That is where we are headquartered.

Mrs. MORELLA. That is where you are headquartered, in the district that I am honored to represent.

What I wanted to ask you—I know we want to hear the other panels, too, and you are responding to three provisions in this particular bill, and they are regulatory, by and large, and you have problems with it, from looking at your testimony and all—where do you think our resources should go? I mean, kind of looking at the big picture. Should it be research? I mean, are we ready to proceed? Would the regulations help in any way? And, I guess you are saying no.

Give us a synopsis of where we should go. Where should our resources be used? So, I would address it to any—all of you.

Ms. DOUGLASS. Well, I will say, from OSHA's perspective, that we need the research and we need the information to establish the standard that we need in order to regulate, and that standard for OSHA to regulate is, we must show a significant risk of material impairment of health, and we must show technical and economical feasibility of a solution before we can regulate, and we—in the industrial setting, we have quite a bit of information, but in the nonindustrial setting we are working very closely with EPA and NIOSH to gather information on some of these issues, such as biological contaminants and radon and environmental tobacco smoke and other issues. So we need the research.

Dr. SHAPIRO. EPA agrees that we need to continue to focus resources on additional research activity concerning the characterization of the kinds of contaminants you find in indoor settings and their relationships to human health effects, the characterization of building indoor air problems both in terms of diagnosing them and developing appropriate mitigation protocols, and certainly, I think, agreeing with DOE, additional efforts to develop standardized methods and protocols to evaluate emissions from various products is key.

But, in addition to the research, there is a lot we know now, and I think we need to build on the information we do have to get information out to those, both members of the general public and professions, who have some responsibility for indoor air quality. In response to Congressman Swett's comments, I know high priority for EPA is getting out a number of informational documents, many of which we are doing jointly with other agencies, including an architect's guide that will be circulating for public comment, really, beginning tomorrow.

Mrs. **Morella**. How can we push you on that? I mean is there a role that we have to make sure, to set guidelines? I know someone is going to say funding, of course, but is there a role we have in making sure that these other elements also are followed through?

Incidentally, I have heard from a lot of EPA employees. As you know—you know firsthand about some of the indoor air quality problems, and I think you have rectified those.

Dr. **Shapiro**. Well, I think the interest of your subcommittee has been a key element in supporting our efforts, and I think that is really one of the best ways you can do to support us.

Mrs. **Morella**. Mr. Millhone.

Mr. **Millhone**. I would just add, the avoidance of regulatory assignments that are very difficult to pursue. If we are given a regulatory task by statute that entails some of the difficulties that are contained in these sections, a great deal of our resources are spent in trying to respond to that statutory requirement, and in any fixed budget situation those resources then can't be used to support the direction and the fulfillment of research activities that are where the major contribution can be made at this time.

Mrs. **Morella**. Dr. Peterson, did you want to briefly comment?

Dr. **Peterson**. I would only add, just briefly, that from CPSC's perspective, if there is a barrier or handicap to our ability to proceed, it's that frequently we find ourselves in situations where the Congress has given an oversight responsibility to another agency in an area where we already have jurisdiction. So one of the greatest things that the Congress could do is to allow us to proceed where we have jurisdiction and not complicate it by interjecting the authorities or oversight of those other agencies.

Mrs. **Morella**. I appreciate that comment. It is a very valid one, and I thank all of the panel.

Thank you, Mr. Chairman.

Mr. **Scheuer**. Thank you, my colleague.

I want to thank this panel for this very excellent testimony. I appreciate it.

We will now move to the next panel: Mr. Ralph Engel, Dr. James Woods, Ms. Diane Factor.

All right. We will commence the second panel. As you may have heard, we're operating under a strict five-minute rule, but your full testimony will appear in its entirety at the point of the record in which you appear. Okay.

First we will recognize Mr. Ralph Engel, President of the Chemical Specialties Manufacturers Association in Washington.

STATEMENTS OF RALPH ENGEL, PRESIDENT, CHEMICAL SPECIALTIES MANUFACTURERS ASSOCIATION, ACCOMPANIED BY JOHN E. DiFAZIO, JR., REGULATORY COUNSEL; JAMES E. WOODS, PH.D., P.E., PROFESSOR OF BUILDING CONSTRUCTION], COLLEGE OF ARCHITECTURE AND URBAN STUDIES, VIRGINIA POLYTECHNIC INSTITUTE AND STATE UNIVERSITY, ON BEHALF OF THE AMERICAN LUNG ASSOCIATION AND THE AMERICAN THORACIC SOCIETY; AND DIANE FACTOR, INDUSTRIAL HYGIENIST, DEPARTMENT OF OCCUPATIONAL SAFETY AND HEALTH, AMERICAN FEDERATION OF LABOR AND CONGRESS OF INDUSTRIAL ORGANIZATIONS

Mr. ENGEL. Thank you, Mr. Chairman. Good morning.

Before we start, I would like to introduce Mr. John DiFazio, who is our regulatory counsel and accompanying me this morning.

As you indicated, my name is Mr. Ralph Engel. I'm President of the Chemical Specialties Manufacturers Association. CSMA membership consists of over 400 companies involved in the formulation, manufacture and marketing of household and institutional care products. Our members spend considerable resources each year on research and testing, and the industry is constantly striving to ensure not only the effectiveness of its products but also their safety.

CSMA generally supports the objectives of H.R. 1066, specifically additional research into the causes and effects of indoor air pollution, improvements in building systems, and better public understanding of indoor air health hazards.

Permit me to review those specific indoor air quality issues which are of interest to the consumer products industry.

First, we believe indoor air legislation should focus on research rather than regulations or standards for contaminants. Results from this research should be collected and analyzed before Congress considers any regulatory strategy.

Second, we are concerned that the definition of indoor air contaminant as it is applied in certain nonresearch parts of the bill are too broad and need to be more focused.

Third, there is a new House provision, section 16, which we do, indeed, oppose. This provision requires emission labeling for indoor air contaminants in various products, including products containing solvents and pesticides.

The fact is just about any liquid consumer product, Mr. Chairman, includes a solvent, so the category products containing solvents would cover literally hundreds and hundreds of thousands of products. Likewise, many household and institutional care products such as disinfectants and sanitizers are pesticides registered with EPA. To the extent that any of these products present a risk of harm to consumers, warnings of potential risks are already required by Federal law. Should a need for further labeling arise, these statutes provide ample authority and processes for the additional language.

For example, the Federal Hazardous Substances Act, FHSA, already covers labeling of most household and institutional care products.

These same points apply, Mr. Chairman, to household pesticides. Any product making a pesticidal claim must be registered under the Federal Insecticide, Fungicide and Rodenticide Act, and EPA must approve each and every word of the label for that product. As part of this process, each registration is subject to a toxicological review by EPA. This review includes inhalation, as well as other hazards, and EPA requires an inhalation warning on the label if warranted. Again, therefore, the inclusion of emission rate information on the label is not necessary or particularly helpful to consumers.

A further comment regarding products containing solvents is that the level of solvent that a product contains and the volatility of that solvent do not coincide with emissions to the air. This fact was made clear with regard to VOCs in consumer and commercial products during consideration of last year's Clean Air Act Amendments and it is again valid here. Because of the large number of variables which would determine the level of a given exposure—including room ventilation, room size, temperature, humidity, differences in formulation and consumer use patterns—emission labeling for a specific material in a product would be neither accurate nor informative.

For these reasons, Mr. Chairman, CSMA urges that the labeling provisions be rejected.

We would like to close, Mr. Chairman, with a quote from EPA's report to Congress on indoor air quality. We believe it truly captures the essence of this issue:

"Many of the strategies for controlling indoor exposure involve simple, low-cost efforts. For example, awareness of the health risks associated with environmental tobacco smoke can result in lowered exposures as a consequence of voluntary steps to reduce smoking. Also, simple maintenance and cleaning can reduce or eliminate many sources of biological contaminants. In other cases, it is apparent that more can be done to reduce overall exposures and risks by altering building designs and ventilation patterns than by approaching the problem source-by-source or pollutant-by-pollutant."

Mr. Chairman, industry shares that responsibility with the agencies, and to this end we prepared a brochure entitled "Household Care Products and Indoor Air Quality." It advises consumers how to reduce risks from exposure to indoor air contaminants and corrects some of the misconceptions about household care products. We intend to distribute this throughout the country rather liberally.

Thank you for your invitation to testify, Mr. Chairman.

[The prepared statement of Ralph Engel follows:]

TESTIMONY OF RALPH ENGEL

PRESIDENT

CHEMICAL SPECIALTIES MANUFACTURERS ASSOCIATION

BEFORE THE

SUBCOMMITTEE ON ENVIRONMENT

COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY

UNITED STATES HOUSE OF REPRESENTATIVES

MAY 9, 1991

Chemical Specialties Manufacturers Association
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TESTIMONY OF THE CHEMICAL SPECIALTIES MANUFACTURERS ASSOCIATION BEFORE THE ENVIRONMENT SUBCOMMITTEE OF THE HOUSE SCIENCE, SPACE AND TECHNOLOGY COMMITTEE

MAY 9, 1991

My name is Ralph Engel. I am president of the Chemical Specialties Manufacturers Association, 1913 I Street, NW, Washington, DC 20006, which for the past several years has deemed indoor air quality an issue of critical importance to its members.

CSMA's membership consists of over 400 companies involved in the formulation, manufacture and marketing of household and institutional care products, including: detergents and cleaning compounds; disinfectants and sanitizers; waxes, polishes and floor maintenance products; home, lawn and garden pesticides; automotive specialty products; and personal care products. Our members spend considerable resources each year on research and testing, and the industry is constantly striving to ensure not only the effectiveness but also the safety of its products.

CSMA generally supports the objectives of H.R. 1066, specifically: additional research into the causes and effects of indoor air pollution, improvements in building systems, and better public understanding of indoor air health hazards. Last year, CSMA supported H.R. 5155, a similar bill, as reported by the full Committee. While we did not endorse every provision, overall we feel the legislation would have effectively and responsibly addressed these three important goals.

Permit me to review briefly those specific indoor air quality issues which are of interest to the consumer products industry.

First, we believe indoor air legislation should focus on research rather than regulations or standards for contaminants. H.R. 1066 funds research into exposure assessments, health effects, and control techniques, as well as building systems. Results from this research should be collected and analyzed before Congress can properly consider any regulatory strategy. There are hundreds of thousands of products which would be affected by this legislation; without valid risk assessment data upon which to establish that strategy, consumers could become inundated with unintelligible information.

Second, we are concerned that the definition of "indoor air contaminant" as it is applied in certain non-research parts of the legislation not be too broad. If so, it will frustrate EPA's ability to focus on those few contaminants likely to pose a significant threat to human health when found in indoor air. We support, therefore, the language in the health advisory provisions (Section 7) focusing attention on contaminants "likely to occur indoors at concentrations which have adverse human health effects."

Third, there is a new House provision, section 16, which we strongly oppose. This provision requires emission labeling for indoor air contaminants in various products, including "products containing solvents" and "pesticides."

The fact is just about any liquid consumer product, Mr. Chairman, includes a solvent, so the category "products containing solvents" would cover literally hundreds of thousands of products. Likewise, many household and institutional care products such as disinfectants and sanitizers are "pesticides" registered with EPA. To the extent that any of these products present a risk of harm to consumers, warnings of potential risks are already required by federal law. Should a need for further labeling arise, these statutes provide ample authority for the additional language.

For example, the Federal Hazardous Substances Act (FHSA) already covers labeling of many household and institutional care products. Under FHSA the Consumer Product Safety Commission (CPSC) requires manufacturers to provide appropriate warning labeling for any product containing a substance which may cause personal injury or illness through absorption, ingestion, or inhalation. The CPSC has produced hazardous substances labeling guides, primarily for acute hazards, for more than a decade. Furthermore, the CPSC has now proposed to codify guidelines used for many years for labeling for chronic hazards.

A requirement that products be labeled for emission rates would be redundant and of dubious value to consumers on products which already carry a hazard warning pertaining to inhalation, and unnecessary on products regulated under FHSA and the Labeling of Hazardous Art Materials Act (LHAMA) which have been determined not to pose a health risk.

In order for our member companies to label their products appropriately under FHSA, they begin by reviewing the potential routes of exposure that may occur from the use, as well as any foreseeable misuse, of each product. The formula is carefully reviewed -- including inhalation evaluations -- to determine if there are substances which present any hazards indigenous to their use.

These same points apply, Mr. Chairman, to "pesticides." Any product making a pesticidal claim must be registered under the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), and EPA must approve the label for that product. As part of this process, each registration is subject to a toxicological review by EPA. This review includes inhalation, as well as other hazards, and EPA requires an inhalation warning on the label if warranted. Again, therefore, the inclusion of emission rate information on the label is not necessary or particularly helpful to consumers.

Registered pesticide products must be tested to fulfill data requirements under 40 CFR Part 158. The active ingredients also are extensively studied. The inhalation studies often conducted are limit tests, as described in the Pesticide Assessment Guidelines (Acute and Subchronic Toxicity Testing, issued in 1982 then revised in 1984 and clarified in 1989). They are normally performed at an exposure of 5 mg/L (actual concentration of respirable substances) for 4 hours.

Concerning household pesticides in general, I might add that last year EPA reported on the Non-Occupational Pesticide Exposure Study, which examined levels of 32 pesticides in over 200 homes in two cities. EPA concluded that "the noncancer risks were generally low, and the cancer risks were in a range the Agency generally considers negligible with the possible exception of heptachlor and aldrin" (two pesticides no longer in use).

A further comment regarding "products containing solvents" is that the level of solvent a product contains and the volatility of that solvent do not coincide with emissions to the air. This fact was brought up with regard to VOCs in consumer and commercial products during consideration of last year's Clean Air Act Amendments, and it is again valid here. Because of the large number of variables which would determine the level of a given exposure (room ventilation, room size, temperature, humidity, differences in formulation and consumer use patterns, and the like), emission labeling for a specific material in a product would be neither accurate nor informative.

Proponents of the labeling provisions seem to be focusing on total volatile organic compounds (TVOCs). Yet, as EPA noted in its 1989 Report to Congress, "[s]ufficient information is not yet available on many pollutants, such as volatile organic compounds, to warrant the dissemination of the health risk information to the public." The National Center for Environmental Health Strategies, in its April 10 testimony before the House Subcommittee on Health and the Environment, recognized that "under the current EPA focus on [TVOCs] for product labeling, we may be providing consumers information which may lack meaning or be misleading."

Also, in an August 1990 letter to Indoor Air Quality Update, John Girman (now Analysis branch chief in EPA's Indoor Air Division, then Deputy Manager of California's Indoor Air Quality Program) documented the many problems with the several TVOC guidelines, acknowledging that "the biggest problem with the guidelines. . . is that none of the guidelines have a strong basis on demonstrated health effects. All appear to be based more upon what can be practically achieved rather than what is reasonable from a health perspective." Girman noted several analytical problems as well, and concluded that "[s]cientifically defensible guidelines for VOCs in indoor air will not be possible without additional studies of health effects of VOCs at the concentration commonly found indoors."

To conclude our VOC comments, we note that CSMA is already in the process of conforming with California Air Resources Board (CARB) ambient air quality rules which will limit the VOC content of a number of our members' products. In addition, we are working with EPA which is charged under the Clean Air Act Amendments with studying consumer and commercial products to determine the tehcnological feasibility of reducing VOC emissions.

For these reasons, CSMA urges that the labeling provision be rejected. As introduced, H.R. 1066 does limit the applicability of the labeling requirement to products posing "a significant adverse human health threat." Although we view this as a modest improvement because it would narrow the scope of the provision, as we noted previously those few products which do pose a human health threat by inhalation already must comply with FHSA or FIFRA requirements. Therefore, we favor deletion of section 16 in it entirety.

We would like to close, Mr. Chairman, with a quote from EPA's Report to Congress on indoor air quality. We believe it captures the essence of the issue:

> Many of the strategies for controlling indoor exposures involve simple, low cost efforts. For example, awareness of the health risks associated with environmental tobacco smoke can result in lowered exposures as a consequence of voluntary steps to reduce smoking. Also, simple maintenance and cleaning can reduce or eliminate many sources of biological contaminants. In other cases, it is apparent that more can be done to reduce overall exposures and risks by altering building designs and ventilation patterns than by approaching the

> problem source-by-source or pollutant-by-pollutant. Risks from exposures to many consumer products can be reduced by following label instructions and assuring that ventilation is adequate during use. An important role for EPA's indoor air research program is to bring these low cost control options to the attention of the public.

Industry shares that responsibility, Mr. Chairman, and to that end we have prepared a brochure entitled "Household Care Products and Indoor Air Quality." It advises consumers how to reduce risks from exposure to indoor air contaminants and corrects some of the misconceptions about household care products.

Thank you for the invitation to testify. We welcome the opportunity to work with you in passing effective indoor air legislation in the 102nd Congress.

Mr. SCHEUER. Thank you very, very much, Mr. Engel.

Okay. Now Dr. James Woods, American Lung Association, Virginia Polytechnic Institute in Blacksburg, VA.

Dr. WOODS. Good morning, Mr. Chairman, members of the subcommittee.

The American Lung Association and the American Thoracic Society endorses your efforts to provide a means of assuring that all public and commercial buildings will be operated and maintained to meet the health and comfort needs of the occupants. As I testified on April 10, 1991, before Representative Henry Waxman's Subcommittee on Health and the Environment, this investment in our future should be attractive not only as a means of improving our health, but also as a means of achieving significant cost avoidance and improving our national productivity.

We would like to take this opportunity to focus on two issues with regard to section 15 in the proposed legislation, ventilation rates and documentation.

First, on ventilation rates, in section 15(a)(1) for new and newly renovated buildings, only two minimum outdoor air ventilation rates have been specified, 20 cfm per occupant for all occupied spaces, and 60 cfm per smoker in rooms where smoking is permitted. The provision also prohibits the use of recirculated air in spaces where smoking is permitted. However, no ventilation rates are specified in section 15(b)(1) for existing buildings and compliance is required only with the building codes in effect at the time of construction.

Both of these approaches are inadequate to assure acceptable indoor air quality in new, newly renovated, or existing buildings.

The values specified in 15(a)(1) have apparently been extracted from Table 2 of ASHRAE Standard 62-89, but without the context supporting these values. Thus, the intent of the recommended ventilation rates has been confounded. We encourage you to consider incorporating the entire "Ventilation Rate Procedure" of ASHRAE 62-89 into this paragraph so that the potential for system performance can be maximized.

For example, the quality of outdoor air to be used for ventilation is not addressed in this paragraph, nor is the need for control strategies that might be required.

Specifying just these two ventilation rates also allows for significant misinterpretation. For example, if only one-third of the occupants are smokers in a room where smoking is allowed, does 60 cfm per smoker translate to 20 cfm per occupant? If so, the specified ventilation rate in this section is at least a factor of three too low. This specification also precludes the use of air cleaning technology as an alternative or supplement to dilution with outdoor air, although there are situations where air cleaning is more effective than dilution—for example, hospital critical care areas.

Approximately 90 percent of the buildings that will exist in the year 2000 have already been constructed. Many of these buildings are more than 20 years old and have been renovated at least once during their lifetimes. Thus, which building code is now in effect? Occupants in those existing buildings are just as likely to be exposed to indoor contaminants as those in new buildings. Thus, dilution and other methods of air quality control are as important in existing buildings as in new ones. Moreover, the number of people that will be exposed in existing buildings is much greater than in new ones. It is therefore critically important that means of assuring healthy existing buildings be stressed and that building codes that were in effect at the time of construction not be relied upon.

The ASHRAE Standard 62-89 is intended for use in existing buildings as well as in new buildings. We encourage you to consider incorporating the air quality procedure of that standard into 15b(1) so that the potential for maintaining acceptable indoor air quality can be maximized in existing buildings. This procedure is compatible with the ventilation rate procedure but does not require specific ventilation rates. Rather, it allows creative alternatives, like source control, for achieving the system performance within the constraints of the existing building to provide acceptable air quality as determined by objective and subjective measures.

Two other specifications are introduced in 15(a)(1). While energy efficient building design currently allows compliance with the specified envelope leakage, substantial upgrading of construction techniques will be required to comply with the specified duct leakage of not more than three percent. Moreover, paragraph 15(a)(1) does not address the important issue of return air control for acceptable indoor air quality. Many HVAC systems in use today utilize the ceiling plenum for return air pathways. These plenums are seldom clean and allow significant cross contamination between zones. We encourage you to consider the benefits of ducted return air systems for air quality control.

The important related concept of ventilation effectiveness is not addressed in this paragraph. It is included in ASHRAE 62-89 and should be incorporated into this paragraph, explicitly or implicitly.

With regard to documentation, paragraphs 15(a)(2) and 15(b)(2) require the maintenance of documentation of building performance on-site and for the life of the building. The importance of this requirement cannot be overemphasized. However, if ASHRAE 62-89 is incorporated into the bill, it requires also that assumptions used in designing the HVAC system be documented.

Paragraphs 15(a)(2) and (b)(2) are two of the most important in this legislation. To comply with them, however, will require a major change in building industry procedures. Today's industry is fragmented, and continuity of accountability does not exist.

Procedures for producing much of the documentation required in these paragraphs are not currently considered standard practice of the industry. Thus, some change in practice will be required to produce the specified documentation for new buildings. However, much of the specified documentation does not exist, or has never existed. To comply with paragraph 15b(2), then, as-built records will have to be generated in many cases.

Significant training of design, construction and operating personnel will be required to develop and maintain this documentation. We urge the subcommittee to encourage the provision of incentives to those personnel who are charged with the responsibility and accountability for the generation and maintenance of this documentation.

In conclusion, we believe section 15 can advance the design and operations of buildings significantly by establishing a chain of custody for accounting for the health of the Nation's buildings. The American Lung Association and the American Thoracic Society stands ready to assist the subcommittee as it continues to review the Indoor Air Quality Act of 1991.

On behalf of ALA and ATS, I appreciate the opportunity to appear before the subcommittee and would be happy to respond to questions.

[The prepared statement of Dr. Woods follows:]

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TESTIMONY OF JAMES E. WOODS, Ph.D., P.E.

ON BEHALF OF

THE AMERICAN LUNG ASSOCIATION
THE AMERICAN THORACIC SOCIETY

to the

House Committee on Science, Space and Technology
Subcommittee on Environment

RE: H.R. 1066, THE INDOOR AIR QUALITY ACT OF 1991

May 9, 1991

It's a Matter of Life and Breath®
National Headquarters: 1740 Broadway, New York, N.Y. 10019-4374 • John R. Garrison, Managing Director

Mr. Chairman and Members of the Subcommittee, I am James E. Woods, the William E. Jamerson Professor of Building Construction in the College of Architecture and Urban Studies at Virginia Polytechnic Institute and State University, Blacksburg, Virginia. Today I appear on behalf of the American Lung Association and its medical section, the American Thoracic Society, to comment on Representative Joseph Kennedy's Indoor Air Quality Act of 1991 (H.R. 1066) and, specifically, Section 15 of this legislation, "Ventilation Standards For Public or Commercial Buildings." The American Lung Association commends the Subcommittee, and especially Chairman Scheuer, for demonstrating leadership and commitment in addressing this critical legislation and indoor air quality issues overall.

We endorse your efforts to provide a means of assuring that all public and commercial buildings will be operated and maintained to meet the health and comfort needs of the occupants. As I testified on April 10, 1991, before Representative Henry Waxman's Subcommittee on Health and the Environment, this investment in our future should be attractive not only as a means of improving our health, but also as a means of achieving significant cost avoidance and improving our national productivity.

We would like to take this opportunity to offer some constructive criticism of this section that might strengthen its potential for success. These comments will focus on two issues: (1) Ventilation Rates and (2) Documentation.

1. Ventilation Rates

In section 15a(1) for new or newly renovated buildings, only two minimum outdoor air ventilation rates have been specified: 20 cubic feet per minute (cfm)/occupant for all occupied spaces and 60 cfm/smoker in rooms where smoking is permitted. The provision also prohibits the use of recirculated air in spaces where smoking is permitted. However, no ventilation rates are specified in section 15b(1) for existing buildings and compliance is required only with the building code in effect at the time of construction.

Both of these approaches are inadequate to assure acceptable indoor air quality in new, newly renovated, or existing buildings.

The values specified in 15a(1) have apparently been extracted from Table 2 of ASHRAE (American Society of Heating, Refrigeration and Air Conditioning Engineers) Standard 62-1989, but without the context supporting these values. Thus, the intent of the recommended ventilation rates has been confounded. We encourage you to consider incorporating the entire "Ventilation Rate Procedure" of ASHRAE 62-1989 into this paragraph so that the potential for system performance can be maximized.

For example, the quality of the outdoor air to be used for ventilation is not addressed in this paragraph, nor is the need for control strategies that might be required.

Specifying these two ventilation rates only also allows for significant misinterpretation. For example, if only one third of the occupants are smokers in a room where smoking is allowed, does 60 cfm/smoker translate to 20 cfm/occupant? If so, the specified ventilation rate in this section is at least a factor of three too low. This specification also precludes the use of air cleaning technology as an alternative or supplement to dilution with outdoor air, although there are situations when air cleaning is more effective than dilution (e.g., hospital critical care areas).

Approximately 90 percent of the buildings that will exist in the year 2000 have already been constructed. Many of these buildings are more than twenty years old and have been renovated at least once during their lifetimes. Thus, which building code is now in effect? Occupants in those existing buildings are just as likely to be exposed to indoor contaminants as those in new buildings. Thus, dilution and other methods of air quality control are as important in existing buildings as in new ones. Moreover, the number of people that will be exposed in existing buildings is much greater than in new ones. It is therefore critically important that means of assuring healthy existing buildings be stressed and that building codes that were in effect at the time of construction not be relied upon.

The ASHRAE Standard 62-1989 is intended for use in existing buildings as well as in new buildings. I encourage you to consider incorporating the "Air Quality Procedure" of that Standard into paragraph 15b(1) so that the potential for maintaining acceptable indoor air quality can be maximized in existing buildings. This procedure is compatible with the Ventilation Rate Procedure but does not require specific ventilation rates. Rather, it allows creative alternatives (e.g., source control) for achieving the system performance within the constraints of the existing building to provide acceptable indoor air quality as determined by objective and subjective measures.

Two other specifications introduced in 15a(1) are "supply air ductwork shall be designed to permit air leakage less than 3 percent of air flow" and "the building envelope shall have an air leakage (e.g., infiltration) rate of less than 0.75 air changes per hour at 25 pascals." While energy efficient building design currently allows compliance with the specified envelope leakage, substantial upgrading of construction techniques will be required to comply with the specified duct leakage. Moreover, paragraph 15a(1) does not address the important issue of return air control for acceptable indoor air quality. Many HVAC systems in use today utilize the ceiling plenum for return air pathways. These plenums are seldom clean and allow significant cross contamination between zones. We encourage you to consider the benefits of ducted return air systems for air quality control.

The important related concept of ventilation effectiveness is not addressed in this paragraph. It is included in ASHRAE 62-1989 and should be incorporated into this paragraph, explicitly or implicitly (by incorporating the "Ventilation Rate Procedure" into this paragraph).

2. Documentation

Paragraphs 15a(2) and 15b(2) require the maintenance of documentation of building performance on-site for the life of the building. The importance of this requirement cannot be overemphasized. However, if ASHRAE 62-1989 is incorporated into this bill, it requires that assumptions used in designing the HVAC system also be documented.

Paragraphs 15a(2) and 15b(2) are two of the most important in this legislation. To comply with them, however, will require a major change in building industry procedures (i.e., design, construction, and operation). Today's industry is fragmented, and continuity of accountability does not exist. I discussed the concept of continuous accountability in more detail in last month's testimony.

Procedures for producing much of the documentation required in these paragraphs are not currently considered standard practice of the industry. Thus, some change in practice will be required to produce the specified documentation for new buildings. However, much of the specified documentation does not exist (or has never existed). To comply with paragraph 15b(2), then, as-built records will have to be generated in many cases.

Significant training of design, construction, and operating personnel will be required to develop and maintain this documentation. We urge the Subcommittee to encourage the provision of incentives to those personnel who are charged with the responsibility and accountability for the generation and maintainance of this documentation.

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In conclusion, we believe section 15 can advance the design and operations of buildings significantly by establishing chains-of-custody for accounting for the health of the nations' buildings. The ALA/ATS stands ready to assist the Subcommittee as it continues to review the Indoor Air Quality Act of 1991.

On behalf of the American Lung Association and the American Thoracic Society, I appreciate the opportunity to appear before the Subcommittee and would be happy to respond to questions.

Mr. SCHEUER. Thank you very much, Dr. Woods.

Now we'll hear from Ms. Diane Factor, industrial hygienist with the AFL-CIO in Washington.

Ms. FACTOR. Again, thank you for this opportunity, and we want to applaud the efforts of this subcommittee, and particularly yourself, Congressman Scheuer, for your continued interest and action in this area.

We support H.R. 1066 and think this is very necessary and important legislation. As you mentioned earlier, we represent a real constituency that has to deal with this problem on a daily basis. Unions, as their representatives, have to come up with solutions and not just talk about endless research and endless, you know, debate about the problem, but have to come up with some kind of pragmatic solutions which we also see have to be economically, technologically feasible because we don't want to put people out of work or unnecessarily shut down buildings. We think that that technology and that research is done and that we can move forward with some remedies. We like the direction of the legislation, that it is moving more in that direction.

But still and all, we have comments on sections 15, 16 and 17, and let me just say that I don't speak as an individual but on behalf of the AFL-CIO and on behalf of 15 unions who make up a very active work group. We meet regularly and discuss these problems and try to work out our solutions to them. Those unions represent teachers and office workers, as well as the United Auto Workers, Communication Workers. It's a very broad and active work group.

We do have a major problem with sections 15(c), (d), and (f), when you give EPA the total authority to establish standards that then OSHA will have to enforce. As we have always seen, the scope of this legislation covering both residential settings, workplaces and public buildings, requires a really very close joint working relationship between EPA and OSHA. Therefore, we feel it is not appropriate for EPA to develop ventilation standards that would have to be enforced in the workplace by OSHA, just as it wouldn't be appropriate for OSHA to enforce ventilation standards in a residential setting.

So we would like to see that changed, and we would like to see OSHA directed to act in a meaningful way to develop language on ventilation. Though we would also agree that in section 15(a)(1) that very specific language that basically was lifted out of the ASHRAE guidelines and gave very specific numbers for ventilation rates, is also not appropriate. We think it's too rigid to work in a compliance framework.

Quite honestly, our experience over the last 20 years is that wholesale adoption of language out of consensus standards doesn't work in the compliance setting, and we feel that that's what we're here to do, that Congress, with the assistance of the appropriate agencies—and we would certainly be willing to help or support—can craft the kind of ventilation guidelines that we need in this bill and that adopting ASHRAE guidelines in these specific numbers will not work over time and will not pose a true solution.

We also—Gosh, I don't know where to begin when we want to talk about OSHA. I mean, we totally support OSHA having the authority over the workplace, which they do have. But it has been our role, and continues to be our role, that we need to push OSHA to act in a meaningful manner. What OSHA says they're doing, which is they are going to issue a notice for information, is absolutely the bare minimum action they could be taking and—should be taking. They've been promising some action since the fall when they were under court order to do something, and we still haven't seen anything. And then to come out with a notice is totally unacceptable. A notice doesn't even mean that they're going to begin a rulemaking process. And what we've seen in the past, often this can mean the beginning of a ten-year process. So we think this is a real opportunity for Congress to "nudge" them along in a very real way.

What we would like to see is that OSHA come up with a regulation. We think they have a court mandate to do so. If they need a petition from an outside party, we can certainly provide that. We have in the past. But we've kind of played this game where they keep saying they're going to do something and it hasn't been enough. So we would push the agency farther, as well as—So we would take out 17(a)—

Mr. SCHEUER. You'd push them farther and faster, I take it.

Ms. FACTOR. Farther and faster. We would take out the section that requires them to determine if a standard is necessary, and we would push them to actually do that, and that standard would be a performance-based standard, not a specific kind of standard. I've outlined that in the testimony, the areas that we would want to see in that performance-based standard.

And let me just answer your one question, because you brought up the school and the problem with public state and local employees which are not covered.

Mr. SCHEUER. In that connection, how much further research are we going to have to do to determine that those teachers have a right to be protected?

Ms. FACTOR. I don't think we need any more research.

Mr. SCHEUER. —and the workers in that EPA building, which is a sick building in southwest Washington. Imagine, an EPA building of all things.

Ms. FACTOR. That's right.

Mr. SCHEUER. How much research do you have to do when before you're eyes they're dropping like flies, of all kinds of serious health problems.

Ms. FACTOR. I mean, I'm not going to say there are always easy solutions, but there are very common sense things that can be done right now. The problem is that OSHA doesn't have the jurisdiction over state and local employees in 23 states. What we would suggest is language be adopted in this legislation that is very similar to what we achieved in Superfund legislation, which directs OSHA to develop a regulation, not hindered by that barrier of just having to prove definitively material impairment of health. The Superfund legislation is a great model for that.

They went ahead and they developed a regulation to protect hazardous waste workers. They got it in place. EPA also helped in those areas where OSHA did not have authority. It's been a very,

very successful program. We see that as a model that could be used here.

[The prepared statement of Ms. Factor follows:]

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TESTIMONY OF DIANE FACTOR, INDUSTRIAL HYGIENIST
DEPARTMENT OF OCCUPATIONAL SAFETY AND HEALTH
AMERICAN FEDERATION OF LABOR AND
CONGRESS OF INDUSTRIAL ORGANIZATIONS
BEFORE THE ENVIRONMENT SUBCOMMITTEE
HOUSE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
U.S. HOUSE OF REPRESENTATIVES
ON THE INDOOR AIR QUALITY ACT OF 1991 (HR 1066)

May 9, 1991

My name is Diane Factor, industrial hygienist with the American Federation of Labor and Congress of Industrial Organizations. I appreciate the opportunity to appear today to express the concerns of the AFL-CIO on the Indoor Air Quality Act of 1991.

The AFL-CIO applauds the interest and concern demonstrated by this Committee and other Congressional representatives in investigating the role that Congress can play to ensure that workers' health concerns as a result of poor air quality are addressed. We support the Indoor Air Quality Bill (HR 1066) and hope through the involvement of this and other committees that the House of Representatives can produce a piece of legislation that truly gives meaningful recognition to the problem of indoor air quality and finds remedies for those people who are now suffering from health symptoms caused by indoor air pollution.

The AFL-CIO is most interested in ways that this legislation can offer remedies to workers suffering from poor indoor air quality and support the intention of sections 15, 16 and 17 to promote remedies. We have met to discuss these three sections with our work group composed of 15 unions and have identified some concerns we have with the present language. We want to find language that is both clear and specific enough to ensure that the regulatory agencies act in a timely and reasonable way. We do have a problem with sections 15 (c) and (d) and (f) that instruct EPA to establish and evaluate ventilation standards that would be enforced in the workplace by OSHA. EPA and OSHA need to work jointly to develop the standards and work out the appropriate enforcement jurisdiction. Because the scope of this legislation encompasses workplaces, residential settings and public buildings, there is a need for both EPA and OSHA to have enforcement jurisdiction. What is not appropriate is for EPA to develop ventilation standards that would have to be enforced in the workplace, nor ~~for OSHA~~ to enforce ventilation standards in residential settings. OSHA has already declared that they have begun the rulemaking process for an indoor air quality standard. What this legislation can do is direct OSHA to act in a timely and meaningful fashion. This is best accomplished in Section 17.

We want language in the bill that addresses ventilation, but we want this done under the section on workplace indoor air quality protection (section 17). The language in Section 15(a)(1), giving specific number values for supplied air, air changes and leakage, is too rigid to work in a compliance framework and does not address other aspects of effective ventilation systems. The past twenty years of OSHA rulemaking activity, in which the unions of the AFL-CIO have played a primary role, has taught us that wholesale adoption of compliance language from consensus documents, such as the ASHRAE guidelines, is not the best approach. Consensus documents were not written nor tested for use in compliance documents. To emphasize, we want strong ventilation and HVAC system requirements, but worked out by OSHA, using ASHRAE guidelines as one of the criteria, but specifically crafted by Congress and the appropriate agencies to be tailored to the problem of indoor air pollution.

The most appropriate section to accomplish ventilation requirements and other aspects of a comprehensive programs are in the section on workplace indoor air quality protection, Section 17. We want to eliminate Section 17 (a), which requires OSHA to determine if a standard is necessary, and proceed with the development of a standard. We do not agree that "new legislation might confuse and possibly impede progress in this area" (testimony of Gerard Scannell, Assistant Secretary of Labor for Occupational Safety and Health before the House Committee on Energy and Commerce, Subcommittee on Health and the Environment, April 10, 1991) To the contrary, OSHA has been reluctant to act, even though they say they have begun the rulemaking process, and needs a Congressional mandate to direct them to establish a meaningful and timely regulation. OSHA is the agency best equipped to develop and enforce a realistic indoor air quality regulation that would cover commercial and public buildings where workers are the most exposed population. This legislation offers an opportunity to light a small fire under OSHA and get them moving.

Therefore, we want this bill to direct the Secretary of Labor to develop and issue a standard within 2 years. This standard needs to address communication among employers, employees and building owners and clearly delineate accountability. OSHA successfully addressed a very similar problem when trying to sort out communication among owners and employers regarding the location of asbestos installed in structures. We attach this language to our testimony.

We also want to expand on the provisions required by this section. We want to change Section 17 (b)(1 - 6) to follow this general approach:

(1) Written Program: Each employer and/or building owner shall maintain a written plan outlining their program to address indoor air quality. This provision is consistent with other OSHA requirements for safety and health. Guidance to employers is usually provided in an appendix to the OSHA regulation on what should be included in such a program.

(2) Worksite evaluation plan: Requirements for comprehensive evaluations of contaminants and other causes of poor indoor air quality. These evaluations would not be triggered by an overexposure to a OSHA permissible exposure limit, but would be broader in scope to include maintenance and operation of HVAC systems, work practices, etc. The purpose would be to prevent problems.

(3) Building performance standards: General requirements for the safe maintenance and operation of HVAC systems, work practices during operation and renovation, and ventilation to ensure sufficient oxygen and satisfactory air quality. This provision would be general and broad in scope. OSHA shall consider ASHRAE and other guidelines in the development of this provision.

(4) Access to information about the building and materials used that are potentially toxic: This section expands upon the provisions of the Hazard Communication standard to not only provide employees with material

safety data sheets for building materials, pesticides, etc., but information about the design and safe operation of the HVAC system, elevators, etc.

(5) Safe Work Practices: This provision would replace the "exposure limits" provision in the existing bill to more clearly pinpoint the kinds of materials and activities that should be avoided. The problem with linking action in this section to overexposures of existing permissible exposure limits is that these limits were designed for industrial situations where exposures are usually generated by a particular workplace activity, such as welding, grinding or painting. In contrast, indoor air pollution is a ubiquitous presence that fluctuates often with conditions outside of the control of the workers themselves. Therefore, it is difficult to know when and how to sample a particular contaminant and identify the hazard.

This provision would give guidance, from common sense to more sophisticated procedures to avoid and prevent unnecessary buildup of contaminants. This approach would bypass the need to conduct risk assessments for the hundreds of chemical agents potentially present in indoor air and allow OSHA to proceed with pragmatic solutions to most indoor air quality problems.

(6) Education program: Expand to include managers, owners and workers so that together labor and management can work to prevent problems and negotiate pragmatic solutions.

We also recommend the addition of a new section 17(c) that incorporates language that was worked out in the Superfund legislation:

> Not later that 90 days after promulgation of final regulations under subsection (b), the Administrator shall promulgate standards identical to those promulgated by the Secretary of Labor under subsection (b). Standards promulgated under this subsection shall apply to employees of state and local governments in each state which does not have in effect an approved state plan under section 18 of the Occupational Safety and Health Act of 1970 providing for standards on workplace indoor air quality.

The AFL-CIO and our work group of 15 unions are ready to work with this or any other committee to help with specific language changes and promote the timely movement of this important piece of legislation.

training within the previous 12 months." (29 CFR § 1926.58(k)(3)(ii)). This is in recognition of the fact that many abatement workers change employers frequently. Thus, requiring duplicate training from each new employer at each new job would be of *de minimis* benefit to employees. The intent however, of this exception was not to shift to the employee the cost of required OSHA training, nor to encourage him/her to obtain, at employee expense AHERA certification within 12 months of applying for work covered by the OSHA standards.

OSHA has been informed that in certain regions employers are requiring AHERA certification as a condition of employment for abatement work covered by OSHA standards. The Agency is interested in comments and information concerning how widespread such a practice is; whether the reason is to shift the OSHA training cost to employees, or whether there are other reasons; whether such a practice results in little or no job site training; and if so, how employee health and safety are affected.

D. Proposed Extension of Reporting and Information Transfer Requirements

1. Notification and Reporting Requirements

OSHA is proposing expanded notification and reporting provisions in the construction standard to respond to the Court of Appeals remand order and to incorporate some recommendations of the Advisory Committee on Construction (Exhibit 1-128).

The Court's decision dealt with two notification and reporting issues. First BCTD has asked OSHA to require employers contracting asbestos-related work to establish, maintain and transfer to building owners written records of the presence and locations of asbestos or asbestos products, in order to facilitate identification and prevention of asbestos hazards. The Court remanded this issue so that the Agency reach "its own judgment on the issue" of whether it was legally empowered to adopt such a requirement (See *BCTD* v. *Brock, supra* at 1278).

The second issue is whether OSHA should require all construction industry employers to file reports with it prior to engaging in any asbestos work, as maintained by BCTD. The Court remanded the issue for consideration on remand, after finding that the record contains "uncontradicted (and unanalyzed) evidence of non-*de minimis* benefits" (*Id*).

The following discussion explains OSHA's proposal as it pertains to certain of these issues. First, OSHA discusses its expanded provisions dealing with notification by and between employers and building owners in order to facilitate identification of and protection from asbestos in buildings. Second, OSHA discusses proposed provisions requiring some construction employers to report asbestos-related work to the Agency before it is begun.

2. Communication Among Employers, Employees and Building Owners

a. *Notification to and from building owners.* Current regulations, in paragraph (d), require employers to notify other employers in the building of the existence and location of asbestos work. However, the Agency had applied a narrower definition to the term "employer" based on its concern that building owners were "outside the domain of the OSH Act." (OSHA Brief at 96). As noted above, the Court remanded this issue to OSHA for further consideration in light of the statutory prescription that standards are to require conditions, or the adoption or use of one or more practices, means, methods, operations, or processes reasonably necessary or appropriate to provide safe or healthful employments and places of employment" (29 U.S.C. 652(8)). Upon further analysis, the Agency believes that it has authority to require building owners who are statutory employers to take necessary and appropriate remedial action such as notifying other employers, to protect employees other than their own. In other standards OSHA has required building owners and other employers who are not the direct employers of the employees exposed to a particular hazard, to warn of defects, take remedial action or provide information to the directly employing employer. For instance, the Hazard Communication standard requires that manufacturers provide information to downstream employers to protect their employees (29 CFR 1910.1200). The powered platform standard, promulgated in 1989, (54 FR 31408, July 28, 1989, at 31412-3) requires the building owner to assure the contract employer that the building and equipment conform to specified design criteria.

Because it is evident that the building or project owner is the best and often the only source of information concerning the location of asbestos installed in structures, OSHA believes it is appropriate to require the owner to receive, maintain, and communicate knowledge of the location and amount of asbestos-containing materials, to employers of employees who may be exposed.

b. *Communication provisions.* OSHA is proposing a comprehensive notification scheme for affected parties—building owners, contract employers and employees, to assure that information concerning the presence, location and quantity of asbestos-containing material in buildings is communicated appropriately and in a timely manner to protect employees who will work with or in the vicinity of such materials. OSHA has reviewed and incorporated in the regulatory text many suggestions recommended by ACCSH at its March 14, 1990 meeting.

The highlights of the proposed notification scheme are as follows. Before non-small-scale, short duration renovation, removal or demolition operations take place, building and/or project owners must notify their own employees and employers whose employees may work in or contiguous to the areas of such operations, of the quantity and location of asbestos-containing materials present in such areas. Employers who have not received notice from the building owner of impending asbestos-related activity, must notify the building owner if the employer is planning any such covered activity and of the location and quantity of asbestos material known or later discovered. The building owner must keep record of all information received through this notification scheme, or through other means, which relates to the presence, location and quantity of asbestos-containing materials in his/her building and must transfer all such information to successive owners.

Other employers may not normally be aware of projects going on in other parts of the building, including regulated areas. Staff and crews not working directly with asbestos, tremolite, anthophyllite, or actinolite may nevertheless come into proximity with the regulated areas, and these staff are unlikely to be aware of the hazards of these substances and of appropriate protection measures. Because the safety and health of his or her employees in the workplace is the responsibility of the building owner, the Agency believes that the building owner must also notify his/her employees who may work near where the work with asbestos is being done. OSHA believes that the employee's presence in the workplace places him at increased risk from asbestos exposure regardless of whether he/she is actually working with asbestos.

Additionally, the proposal expands OSHA's current employer notification

Mr. **Scheuer.** It seems to me that even where a Federal agency doesn't have specific jurisdiction over the health of teachers, and let's assume that that's left to local and state officials—education is a local and state responsibility—that nevertheless, we could have a hortatory effect, it seems to me, and we could have language and we could have findings and we could have statements when this kind of a situation prevails, it is incumbent upon local and state officials to consider it their obvious duty to protect the health of teachers.

It seems to me, if we had some kind of language like that, it would give the local teachers union something to grab on, the local PTA something to grab on, the local labor union something to grab on, and that you'd give them at least a handle to start whupping, to start, as you say, "nudging" the local school authorities to face up. This is not a condition; it's a—Excuse me. As Grover Cleveland said over a hundred years ago, "we're faced not with a theory but a condition", and it must be addressed.

I must say, over the years that I've been involved in the work of the Congress, and specifically the work of this committee, you run into a phenomenon that rages far and wide, where the perfect is the enemy of the good. If there is any scintilla of doubt about the finality and the absolute provability of conditions, we can't act, we can't act. We always have to know more. By the time we know more, there's always more to know.

That was my experience with the EPA when it came to acid rain. Every year, over a long number of years, the administration would say we can't act on acid rain; we don't know enough; we don't know enough. Their position has always been, if we don't know everything, we can't do anything. Of course, that is a trap that must be avoided like the plague.

Ms. **Factor.** You know, we often say that there's a scientific method being used. It's called "the body in the morgue". Unfortunately, with workers, they have counted the bodies in the morgue before they felt they had scientific evidence to act. That has happened on asbestos and a number of carcinogens in the workplace before OSHA has regulated or done something.

We certainly think that there is enough evidence there, enough information, to act, rather than wait and, like you say, until more people drop like flies.

Mr. **Scheuer.** All right.

My colleague from Pennsylvania, Congressman Don Ritter.

Mr. **Ritter.** Thanks, Mr. Chairman. I apologize for having three contemporaneous other hearings, where I'm either Ranking or activist, and markups at the same time. So, I missed these very important witnesses.

I just wanted to point out that I heard the interchange, very interesting interchange, between the Chairman and the gentlelady, Miss Factor. I just wanted to point out that I think we had better darned well not avoid, through legislation, the attention to good science. I have seen, in 12 years of being in the United States Congress, legislation move forward which was not based on good science. There is so much of our regulatory legislation which is based on poor science, frankly, or no science at all. As a matter of fact, we have done things to—we have done major legislation here which avoided science.

I only call attention to one glaring example. The National Acid Precipitation Assessment Program was a ten-year effort, started in the Carter Administration, sponsored initially by Daniel Patrick Moynihan. It was assiduously avoided in any consideration by our Subcommittees and Full Committee when it came to marking up the acid rain provisions of the Clean Air Act. I don't think it is wise to say that, somehow, we've got to move before we have the science. We have moved a great deal, Mr. Chairman and members of this panel, without a scientific base. I think we have a tendency to become "chemophobic" in America.

You know, it's one thing to just do away with nuclear energy, you know, on the basis of fear and a lack of good science, frankly. You cut your leg off, and you walk around with the peg leg, and you limp. But, the overall impact of "chemophobia" is something which is infusive to the very bloodstream of manufacturing in America. The AFL-CIO, I would hope, recognizes this: that made in America, manufacturing in America, products that are American, processes that are American, all use chemicals, and all are dependent on chemicals. To exorcise chemicals from our lives, as if they are some kind of "Salem witch," at all costs, at all levels, in disregard of the scientific data, is a policy doomed to failure. It is uniquely an American policy, in terms of our jobs, our prosperity, our AFL-CIO manufacturing base. It's not a good strategy, Mr. Chairman. Again, I think these issues are very complex.

Let me make one question out of this. Indoor air quality issues are complex, with uncertain scientific answers, requiring research, additional research. There seems to be substantial concern, in particular, about the scientific evidence. I would like to hear from some people as to why these new provisions should be in a bill at all, at this point.

Dr. Woods, do you want to try that?

Dr. Woods. I would like to maybe comment a little bit on that. With regard to the section on documentation, I think what Mr. Swett was talking earlier this morning, about the roles of the architect and the professions, one of the major problems that we have to deal with today is that people live in these buildings regardless of whether science goes on or not. We've got to deal with the reality of today's situations.

One of the biggest problems I think that we face is that we do not have the commitment to operate the buildings according to the technology and the science that we have available to us today. We don't need new science to be able to operate our buildings correctly. We don't need new science to design our buildings correctly. We can use new science to help us do a better job, but we know how to do a pretty good job now. We've got centuries of experience behind us. What we don't have is the motivation to maintain those buildings the way they should be maintained and operated.

I think section 15(b) goes a long way towards providing the motivation, including the penalties and the fines that are associated with that, to maybe put in place the type of regulation that's enforceable. I'm not sure at this point that enforcing specific contaminant concentration levels in every occupied space is enforceable.

But I do think that enforcing good practice, good standard practice, is available.

Mr. RITTER. So, there are some things that you think could happen that may not encompass all these three sections, but it's kind of a more intelligent ventilation policy. But, ASHRAE says you just have two rates of ventilation. Well, you don't have to be a rocket scientist to know that there's going to be a whole host of different structural requirements in buildings and that they're going to have different ventilation rates for different conditions—

Dr. WOODS. Right.

Mr. RITTER. —all over the map. You would also be concerned, there, that you don't just use, as a kind of Federal standard, a Federal mandate that—you know, can end up with all kinds of unintended effects, which is often what happens when we do things in complex applications all over the country.

Dr. WOODS. Absolutely. That's as we testified.

But I think more than just looking at the ventilation rate, that's indicative of the more comprehensive problem of how you design, operate and maintain buildings. That's why I like the 15(b)—

Mr. RITTER. Okay. And, you're saying we have that kind of information available. In other words, we would know how to better deal with the flow of air in buildings to have cleaner indoor air. Right now, we don't need to go any further, and we just regulate to make this happen?

Dr. WOODS. To a great extent, that's true, that the profession is out there. The history is out there. What we need to do is implement it.

Mr. RITTER. I thank the Chairman.

Mr. SCHEUER. Let me say that all of these chemicals that can be lethal—and have turned out to be lethal in a considerable number of cases—were produced, manufactured, built into products, as part of a consumer demand for those products. No manufacturer, out of venality and evil intent, manufactured those chemicals. They all came in response to a demand.

But the fact is that our knowledge of science has built up our ability to measure toxic chemicals, has increased exponentially in the last decade, so that now we can measure a fraction of a drop of dioxin in an olympic swimming pool and identify that pool as contaminated.

Again, we run into the question: do we have to know everything to know anything? I say that we don't. There's empirical evidence out there that chemicals are lethal, chemicals that were put into the stream of commerce with perfectly good intentions. We shouldn't be pointing the finger of blame. We're all responsible for wanting those things, and manufacturers and scientists produced products for which there was a consumer demand. We find out that there's a lethal price tag, or a serious health price tag on them, and the responsible thing for us to do is to use science as best we can, not insisting that we have a one-on-one cause and effect relationship, before we say that some of these chemicals can be lethal and that we ought to use reasonable means to control them and limit them.

My colleague talked about the NAPAP report. That report was based on very sound science, but grossly misinterpreted by the top policymaking officials in that agency. They finally admitted that they had grossly misinterpreted the information and that they would rewrite the report, coming from questions and criticisms that we had put to this—that we had put to those officials. They finally admitted that they grossly abused the basic science—

Mr. RITTER. Okay.

Mr. SCHEUER. —that their scientists had produced.

I don't want to get into a big debate with you, my honored colleague. You made your speech, I made my speech. I'm now going to recess this meeting for about ten minutes so we can go vote.

There will be a third panel. I would ask unanimous consent that any member who has further questions to ask, or further comments to make, be able to make them and to ask the questions by mail. We'll hold the record open for ten days or two weeks so that my colleague from Pennsylvania or any of the other members can make their statements for the record and ask their questions for the record.

Thank you very much.

[Recess.]

Mr. SCHEUER. All right. Okay. This is the last panel this afternoon. We have five members of the panel.

We are running very, very late. I would like to put you on a four-minute limit, if I may, and then we'll have time for a few questions afterward. Of course, your prepared remarks will be printed in their entirety in the record.

Okay. Let's hear from Mr. Walter Reckinger, Sheet Metal and Air Conditioning Contractors' National Association in Washington. Mr. Reckinger.

STATEMENTS OF WALTER RECKINGER, III, VICE PRESIDENT AND GENERAL MANAGER, RECKINGER HEATING AND COOLING, ON BEHALF OF THE SHEET METAL AND AIR CONDITIONING CONTRACTORS' NATIONAL ASSOCIATION, INC.; JOHN WOLFERT, DIRECTOR OF MECHANICAL ENGINEERING, MELVIN SIMON & ASSOCIATES, INC., ON BEHALF OF THE BUILDING OWNERS AND MANAGERS ASSOCIATION INTERNATIONAL, THE INTERNATIONAL COUNCIL OF SHOPPING CENTERS, THE NATIONAL APARTMENT ASSOCIATION, THE NATIONAL ASSOCIATION OF HOME BUILDERS, THE NATIONAL ASSOCIATION OF INDUSTRIAL AND OFFICE PARKS, THE NATIONAL ASSOCIATION OF REALTORS, THE NATIONAL MULTI HOUSING COUNCIL, AND THE NATIONAL REALTY COMMITTEE; ALAN HEDGE, PH.D., ASSOCIATE PROFESSOR, DEPARTMENT OF DESIGN AND ENVIRONMENTAL ANALYSIS, CORNELL UNIVERSITY; ARTHUR E. WHEELER, P.E., BUILDING ENGINEER, TOWSON, MD.; AND JOHN JANSSEN, CHAIRMAN, ASHRAE STANDARDS PROJECT COMMITTEE 62-1989, ON BEHALF OF THE AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS

Mr. RECKINGER. Mr. Chairman, thank you. My name is Walter Reckinger, III, and I am vice president and general manager of Reckinger Heating and Cooling Company in Dearborn, MI. I am a sheet metal and air conditioning contractor performing sheet metal, energy management and indoor air quality work in the commercial construction and retrofit markets. My firm is a member of SMACNA and I appear here today on behalf of the Sheet Metal and Air Conditioning Contractors' Association Association.

I would like to add that my statement is also endorsed by the National Energy Management Institute, NEMI, and the Sheet Metal Workers International Association, both of which are leaders in the IAQ effort nationally.

I am here today in support of H.R. 1066, the Indoor Air Quality Act of 1991.

Indoor air quality has been a concern of SMACNA for many years. In 1988, after much research, we published the first edition of our indoor air quality manual. During research, prior to developing and publishing the manual, we discovered that a leading contributor to the problem of indoor air quality is the country's efforts to reduce energy use in buildings. Better insulation and reduced ventilation rates have saved energy, but have also trapped contaminants within buildings.

Among the findings of this bill is the statement that "exposure to indoor air contamination can be reduced through the proper design, operation, and maintenance of heating, ventilating, filtration, and air conditioning systems in buildings". That finding concurs with private industry studies and with the ventilating requirements of the American Society of Heating, Refrigeration and Air Conditioning Engineers Standard 62-1989. The problem now is how to achieve adequate ventilation to improve indoor air quality without sacrificing the energy savings achieved by energy conservation measures.

SMACNA is heavily involved in the energy management field and is consistently and constantly seeking new methods to achieve improved indoor air quality and energy efficiency. The concepts of IAQ and energy efficiency are inextricably linked. To increase energy efficiency and conservation without addressing subsequent IAQ problems is a policy approach with potentially harmful health outcomes.

It is important to emphasize that the ability and technology exists today to accomplish the goals of the Indoor Air Quality Act of 1991. In my remarks that I submitted earlier, there is a sample of a building in Washington, D.C. which demonstrates the minimal increase in energy costs for increased exchange of outside air.

I would also like to point out that we have several case studies of buildings that have had energy management retrofits performed on them by SMACNA contractors, in concert with NEMI, and we have not only improved the indoor air quality of the buildings, but have reduced energy consumption at the same time. One classic example building is the United Unions Building here in Washington, D.C., which even after an indoor air quality retrofit and energy retrofit package, we are still saving $188,000 a year in energy costs.

SMACNA was involved with the research and development of the ASHRAE Standard 62-1989 and we recommend that this standard be specifically referenced as criteria for Federal and public buildings. On the surface, the ASHRAE standard, allowing a minimum of 15 cubic feet per minute, may seem less stringent, but we feel that the approach of controlling known and specifiable contaminants is one that we need to address, and that is addressed in the tables contained in the standard.

I thank you for the opportunity to present testimony here today.

[The prepared statement of Mr. Reckinger, follows:]

Statement
of
The Sheet Metal and Air Conditioning Contractors' National Association, Inc., SMACNA
on
HR 1066
The Indoor Air Quality Act of 1991
to
The House Science, Space and Technology Committee
Environment Subcommittee

May 9, 1991

Mr. Chairman, my name is Walter Reckinger, III and I am Vice President and General Manager of Reckinger Heating and Cooling of Dearborn, Michigan. I am a sheet metal and air conditioning contractor performing sheet metal, energy management and indoor air quality work in commercial construction. My firm is a member of SMACNA and I appear today on behalf of the Sheet Metal and Air Conditioning Contractors' National Association, Inc. (SMACNA).

SMACNA is supported by more than 5,000 construction firms engaged in industrial, commercial, residential, architectural, and specialty sheet metal and air conditioning contracting throughout the United States. I am here today in support of H.R. 1066, the "Indoor Air Quality Act of 1991."

INDOOR AIR-QUALITY

Indoor air quality has been a concern of SMACNA for many years. In 1988, after much research, we published the first edition of our "Indoor Air Quality" Manual. The manual is one of the major resources in use today by design professionals and contractors when making improvements to indoor air quality of new and existing buildings. During research, prior to developing and publishing the manual, we discovered that a leading contributor to the problem of indoor air quality is the country's effort to reduce energy usage in buildings. Better insulation and reduced ventilation have saved energy, but have also trapped contaminants within buildings.

Among the findings of this bill, is the statement that "exposure to indoor air contamination can be reduced through the proper design, operation, and maintenance of heating, ventilating, filtration, and air conditioning systems in buildings". That finding concurs with private studies and with the ventilating requirements of the American Society of Heating, Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 62-1989. The problem now is how to achieve adequate ventilation to improve indoor air quality without sacrificing the energy savings achieved by energy conservation measures.

ENERGY MANAGEMENT

SMACNA is heavily involved in the energy management field and is constantly seeking new methods to achieve improved indoor air quality and energy efficiency. The newest edition of SMACNA's "Energy Recovery Manual" is in the final stages of review prior to publication. This manual includes information on all current technologies to provide energy management without sacrificing indoor air quality. It is important to emphasize that the ability and technology exists today to accomplish the goals of the Indoor Air Quality Act of 1991.

As an illustration, a study involving a 100,000 square foot office building in the Washington, DC area concluded through two energy-cost simulations that an increase from 5% outside air to 20% outside air cost only $1,800 on an annual basis. That amounts to 2 cents per square foot. That same study compared the cost of absent or sick workers affected by unhealthy ventilation and concluded that increased ventilation cost 1/135th of the cost of absent and sick employees. A summary of the results of this study is attached.

VENTILATION RATES, INDOOR AIR QUALITY AND ENERGY MANAGEMENT

SMACNA was involved with the research and development of the ASHRAE standard 62-1989 and we recommend that this standard be specifically referenced as criteria for Federal and public buildings. On the surface, the ASHRAE standard, allowing a minimum of 15 cubic feet per minute (cfm), may seem less stringent than the minimum ventilation requirements of the bill in Section 15(a), which establishes 20 cfm as the standard. However, the ASHRAE standard provides a design basis which takes into account controlling known and specifiable contaminants. When certain contaminants are expected, the ASHRAE standard will increase the minimum amount of outdoor air accordingly.

This bill, in its present form, mistakenly sets standards that are primarily directed at increasing ventilation rates which will dilute the indoor air contaminants. The ASHRAE standard, on the other hand, considers source control and filtration as well. This additional control allows less ventilation air to achieve the same result, which also means less requirement for energy.

There is some concern that an increase in the ventilation rates in existing buildings would force the building owners to provide additional heating and/or cooling equipment. This is not the case. The ASHRAE study which generated standard 62-1989 indicated that most buildings in existence today have been designed to handle the increased loads of outside air by changing operating procedures rather than retrofitting.

CERTIFICATION

Another expressed concern is that there may be a lack of standards and/or protocol for certifying a building for compliance to indoor air quality standards. The ASHRAE Standard 62-1989 provides tables for minimum acceptable levels of various contaminants for indoor, outdoor, and industrial workplaces. The tables list all the presently known contaminants that contribute to health problems. All of these contaminants are measurable at any point in the building by instrumentation currently available.

In addition, measuring the amount of ventilation is a relatively simple process. All heating, ventilating and air conditioning systems in use today provide for mixing recirculated air from the building with outdoor air prior to doing any mechanical heating or cooling. The percentage of outdoor air is a simple proportion of the resultant mixed air temperature. Also, many buildings today are equipped with computerized monitoring systems which may be programmed to perform this calculation and maintain any records which might be required for certification.

OTHER OBSERVATIONS

SMACNA supports the goals of H.R. 1066 but we are concerned that many of the provisions of the bill are aimed at research, development, and administrative processes rather than attacking the problem directly. As we have testified, much of the research and development has already been done and it would be more effective to expand on this rather than to start from scratch.

In particular, the following sections should be considered with the above concept in mind:

Indoor Air Quality Research

SMACNA encourages further research in this area but believes that increased ventilation under ASHRAE's standards should be the first goal. This should be followed by research to confirm those standards or to establish additional requirements. SMACNA is capable of providing much of the research specified. However, we suggest that the primary research goal should be focused on improving ventilation.

We do concur wholeheartedly with Section 5(i) of the bill which provides for research on buildings that "comply with generally accepted principles of proper design, maintenance, and operation of ventilation, filtration, and other building systems, including ASHRAE Standard 62-1989." This will provide additional data to support or modify an established standard.

Management Practice and Ventilation Standards

Section 6(b)B describes training for the maintenance of records concerning indoor air quality. We urge that such records include operating details which include the percentage of outside air used for ventilation. The majority of building owners will reduce ventilation air whenever possible to reduce their energy costs. Any program which does not require such documentation will probably be difficult to enforce.

National Indoor Air Quality Response Strategy

SMACNA is gratified to see provisions in Section 8(d) and (e) of the bill which emphasizes developing a measurement protocol for certification for contractors. These changes would benefit industry and consumers. Further oversight of IAQ firms and practitioners, including registration, licensing, and certification would improve public confidence and industry effectiveness, if properly developed.

Federal Building Evaluation and Remediation

Section 9(a) of the bill includes a provision for developing a method for determining the actual minimum amount of fresh air delivered per person. SMACNA agrees with this but feels that the program should include keeping records of the actual amount of fresh air delivered as well, for the reasons already mentioned.

SMACNA applauds the provision to select Federal Buildings to be used as a demonstration of energy efficiency technologies that improve indoor air quality. The recognition that the combination is attainable will offer tangible evidence to the public sector and should increase the success of the law once enacted.

However, we are concerned about some of the provisions in Section 9(e). For new Federal buildings, the bill requires employment of "up to date" design, commissioning and operating practices for optimal indoor air quality and energy efficiency. Unless this is tied to some standard, it will be difficult, if not impossible to implement and enforce.

For new and renewed leases for Federal buildings under Section 9(g), the statement, "When available at competitive cost, the leasing of buildings that operate at current ventilation rate standards shall be given priority" will most likely achieve the opposite rather than the anticipated goal. If you specify minimum standards, then building owners will have to comply and, if they wish to stay competitive, they will take the additional steps to maintain energy efficiency.

State and Local Indoor Air Quality Programs

In Section 10(a) it appears that the focus is centered on administrative functions rather than results. We believe that expenditures to state and local governments should be in the form of incentives to adopt indoor air quality standards. Section 10(b)(2)(A) of the bill provides for educating "designing and engineering professionals, about indoor air contamination, mitigation and prevention." We believe that the design community and responsible contractor groups, such as SMACNA, are already at the leading edge of this technology and that this money should be spent on additional research in areas listed elsewhere in the bill.

CONCLUSION

SMACNA appreciates this opportunity to testify and we hope that we have persuaded you that the technology exists today to attain the goals of H.R. 1066. Research indicates that as many as twenty five percent of the existing buildings in the United States currently present a health hazard to the occupants as a result of improper or inadequate indoor air quality procedures. This percentage would be almost zero if proper ventilation standards were used. We support specific reference to ASHRAE Standard 62-1989 as an existing and effective standard and urge the immediate passage of this important bill.

NEMI
Alexander J. Willman, P.E.
Manager of Technical Program Development

COST OF INCREASED OUTSIDE AIR

Parameters:
- 100,000 sq. ft. office building
- Washington, DC area
- 150 sq. ft. per person >> 650 people total
- All electric building w/energy @ $0.09/kWh
- Two AHUS, one for interior & one for exterior
- VAV system w/electric reheat coils in exterior

Annual Energy Cost Simulations: Two energy calculations performed, one using 5% outside air and the second using 20% outside air during all times of building occupancy; all other factors kept constant

Results: Test One @ 5% outside air >> Annual Cost = $216,350
Test Two @ 20% outside air > Annual Cost = $218,150

Cost Difference >>>>>>>>>>>>>>>>>>>>>>>>>>> $1,800
or
>$0.02/sq ft

COST OF ABSENT/SICK WORKERS

Add'l Parameters:
- Average fully loaded cost per worker = $20/hour (includes salary + benefits)
- Each worker paid for 2,080 hours/year

Annual Payroll Cost: $20/hour x 2080 hrs/yr x 650 workers =
$27,000,000/yr
or $270/sq. ft.

Annual Cost of 1% Absent Workers: 0.01 x $27M = $270,000/year
or
$2.70/sq. ft.

CONCLUSIONS

Cost of Increased Ventilation >>>>>>>>>>>>>>>>>>>>>> $0.02/sq. ft.
Cost of Absent Workers >>>>>>>>>>>>>>>>>>>>>>>>>>>> $2.70/sq. ft.

Increased Ventilation Cost is 1/135th of the Cost of Absent & Sick Office Workers!

Mr. **Scheuer**. I thank you for your testimony, Mr. Reckinger.

We will now turn to Mr. John Wolfert, representing the Melvin Simon Management Company of Indianapolis, IN. Please proceed, Mr. Wolfert.

Mr. **Wolfert**. Thank you.

My name is John Wolfert. I'm director of mechanical engineering for Melvin Simon & Associates, a large developer of shopping centers throughout the country. The written testimony we have submitted discusses several issues of the proposed legislation, but I've been asked to discuss the ventilation standards in representing eight various real estate organizations.

First of all, the real estate organizations that I've discussed this with all support some method of improving indoor air quality. There's no question about it being a problem of sorts.

The appropriate ventilation measures are one approach to improving the situation, but we are opposed to the exact language as stated in the proposed legislation. It would appear that the addition of outdoor air is viewed as an all-purpose solution to a widespread problem. First of all, we do not believe the problem is as widespread and that most commercial buildings operate without reported indoor air quality problems. Obviously, there are some that do exist, but we don't consider them widespread.

Market pressures from our tenants, our customers, and occupants of the building dictate that we, in well-run buildings, must maintain proper indoor air quality. We're forced to by these paying customers. The existing state and local ventilation and energy codes also dictate solutions to these problems.

Many of the indoor air quality problems are not specifically solved by increasing the outdoor air quantities. This solution is already being applied. Regional code groups have adopted, or are in the process of adopting, the new ASHRAE standards. They have customized it to fit their local needs based on their particular situation and energy generation requirements in the area, and the process of adopting these standards is not necessarily a slow process. It's being done fairly rapidly by local and state organizations. For instance, New York State, as I understand it, has adopted the ASHRAE Standard 62.

Individual building owners are, of course, free to use those standards, and in our case we use them as a method for designing our systems.

In a shopping center, the provisions of the bill would require six times as much outside air as the present codes require, or the ASHREA standard requires, and 12 times what many of the codes require, because of the smoking requirement. If we analyze what happens to a building with that requirement, we will see substantial increases in building costs and energy costs. I've done that for a shopping center we have in St. Louis, MO. It's a 530,000 square foot building. I've taken the building as it exists and the energy consumption as it exists and scaled it up to the requirements for outside air based on the wording of the legislation.

In simple terms, the cooling capacity required in the cooling plant would increase by 148 percent. Construction cost of the mechanical system, or the air conditioning system, would increase by 38 percent, representing about $2.4 million for this particular building, more than $5 a square foot. The annual energy consumption for cooling would increase 148 percent. The increase in energy for heating would go up by over a thousand percent. The annual energy costs for heating and air conditioning would increase by 247 percent, or the overall energy costs of the building would increase by 48 percent. That number represents approximately $500,000 a year for a 500,000 square foot building.

Those increases are economically very difficult to deal with. These energy costs—

Mr. SCHEUER. Could I interrupt and ask a question?

Mr. WOLFERT. Certainly.

Mr. SCHEUER. We don't have all that many members here.

Don't you have a way of passing through increases in heating and air conditioning to your tenants? Don't you have a pass-through for the increase in taxes, heating and air conditioning and the like?

Mr. WOLFERT. We consider our tenants in partnership with us, and yes, legally, you're correct, that we do pass through the costs. But if we increase his cost to the point where it destroys his business, we both get hurt.

Mr. SCHEUER. Well, when you say you increase the costs a half-a-million dollars for 500,000 square feet, what's the rent roll on that building and what percentage increase is this in the rent that you have to get to have a reasonably profitable building?

Mr. WOLFERT. Those rents, as I recall, will run between $15 and $22 a square foot.

Mr. SCHEUER. So you're talking about maybe a five percent increase in the rent due to the increase in heating and—

Mr. WOLFERT. Five percent, correct.

Mr. SCHEUER. Okay. I don't consider that—over a period of years, I don't consider that an outrageous increase. That would be legitimate for you to pass on and I don't know why you would hesitate to pass it on, if you can justify, on a common sense basis, if you can justify those efforts as resulting in a significant and reasonably identifiable increase in that building from a health and safety point of view.

Mr. WOLFERT. In that particular building, of course, we are not the recipient of any complaints about indoor air quality, so I don't know that we would really need to increase outdoor air to solve problems that don't exist.

Mr. SCHEUER. First of all, you don't know if they exist or not, just because people haven't been complaining about it. There may be toxic substances, there may be other problems with air quality, that the people can't identify. Now, when you have people dropping like flies, as you do in the EPA building in southwest Washington, or even in this school building, then you know there's a real problem. But I suppose you might have a problem that people couldn't identify.

If there is no problem, I wouldn't want to mandate a five percent increase in their rent. I wouldn't want to mandate any of these expenditures. I hope by the time we finish this hearing, this panel, we'll get some idea of whether that five percent increase in rent is productive and makes that a better, safer, healthier building for people to work in. If it's not, if it's just silliness, we shouldn't be mandating it.

Please proceed. I didn't mean to interrupt.

Mr. **Wolfert**. Another reason that we're concerned about the language in the proposed legislation is that it does not permit the use of alternative measures to be taken in addition or in lieu of increased outdoor air quantities. The ASHRAE standard does provide these measures, which are not referenced in the legislation.

The real solutions, as we see it, are increased education of the owners, managers, occupants, building professionals in general, in reference to these particular problems; perhaps increased funding for EPA to disseminate research and actual information to building professionals; perhaps some method of certification of indoor air quality inspectors; voluntary efforts as to source emissions control or reduction; and encouraged use of the guidelines such as published by ASHRAE for commissioning of buildings, which includes maintenance procedures as well as fine-tuning the building to make it perform as it was originally designed.

The efforts of various agencies to distribute and provide information to the building professionals we feel is one of the major sources of benefits that can be achieved. If this information can be developed and gotten out to building owners, building professionals, building operators, then we have a better chance of not only educating them but convincing them that improvements of maintenance and operation of their systems are the necessary solutions for improving the situation.

Thank you.

[The prepared statement of Mr. Wolfert follows:]

TESTIMONY OF

BUILDING OWNERS AND MANAGERS ASSOCIATION
INTERNATIONAL COUNCIL OF SHOPPING CENTERS
NATIONAL APARTMENT ASSOCIATION
NATIONAL ASSOCIATION OF HOME BUILDERS
NATIONAL ASSOCIATION OF INDUSTRIAL AND OFFICE PARKS
NATIONAL ASSOCIATION OF REALTORS
NATIONAL MULTI HOUSING COUNCIL
NATIONAL REALTY COMMITTEE

ON

H.R. 1066

INDOOR AIR QUALITY ACT OF 1991

PRESENTED TO

THE SUBCOMMITTEE ON ENVIRONMENT

OF THE

COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

OF THE

UNITED STATES HOUSE OF REPRESENTATIVES

PRESENTED BY

JOHN WOLFERT
DIRECTOR OF MECHANICAL ENGINEERING
MELVIN SIMON & ASSOCIATES, INC.

MAY 9, 1991

SUMMARY

I. Non-Regulatory Provisions

The bill contains several provisions that would assist building owners and managers in preventing and solving indoor air quality problems: additional indoor air quality research; the issuance of technology and management practice bulletins; the development of model building management practices training curricula; a study of the adequacy of ventilation standards; a program to deal with the indoor air quality problems in federal buildings; and increased funding for the EPA's indoor air quality efforts (the most important part of the bill).

The bill contains other provisions that would not be particularly useful, and indeed could be counterproductive: the health advisories section and the national indoor air quality response strategy and the building assessment demonstration provisions, which do not appear to add to the authority of, or provide new direction for, the agencies involved and could result in inappropriate regulation or inappropriate public reaction to the presence of substances in building air.

We support the enactment of legislation including the provisions that would be helpful and not including the provisions that would not be helpful.

II. Regulatory Provisions

A. Ventilation Standards

We do not oppose the regulation of ventilation standards in commercial buildings (we note that neither ASHRAE 62-1989 nor the bill applies to residential facilities, including multi-family buildings). We believe that commercial building ventilation standards are, and should be, regulated by state and local building codes as is currently the case, and we support ASHRAE 62-1989 as the basic standard for consideration by building code officials in the revision of their ventilation standards. However, we do not support the adoption by the federal government of ASHRAE 62-1989 or any other national ventilation standard.

We strongly oppose the ventilation standards provision contained in section 15 of the bill for the following reasons.

1. The provision imposes very specific new regulation of building ventilation standards without the benefit of the research that the Committee, in last year's bill, decided was necessary to determine what federal government actions, if any, would be appropriate regarding such standards.

2. The provision imposes federal regulation in an area already regulated at the state and local level.

3. The provision is significantly at variance with and more stringent than ASHRAE 62-1989 or any other ventilation standard currently in use or proposed. Both the requirement of 60 cfm/person and 100 percent exhaust for buildings in which smoking is

permitted and the 20 cfm/person outdoor air requirement for nonsmoking areas are substantially in excess of ASHRAE 62-1989 requirements, current building code requirements, and the levels necessary to maintain acceptable indoor air quality in many facilities.

4. The provision would substantially increase building costs for heating and cooling and for additional boilers and chillers and other equipment.

5. The excessive ventilation requirements of the provision would result in major increases in energy consumption that would create a demand for additional electric power generation capacity and increase the outdoor air pollution resulting from the generation of such electricity.

6. The ventilation rates would be virtually impossible to achieve in many existing buildings, even if they are substantially renovated.

7. Increased ventilation would not solve all indoor air quality problems.

8. The increased outdoor air ventilation requirements of the ventilation standards in the bill would degrade indoor air quality in situations where outdoor air quality is poor.

9. The ventilation standards in the bill are unnecessary in many buildings that have adequate indoor air quality at lower ventilation rates.

10. The ventilation standards in the bill would exacerbate the energy consumption increases resulting from the recently enacted restrictions on the use of chlorofluorocarbons (CFCs).

11. The ventilation standards in the bill do not permit the use of an alternative indoor air quality procedure.

The incorporation by reference into the bill of ASHRAE 62-1989 would not solve all of the problems discussed above arising out of the adoption of the ventilation standards in the bill, and several of the reasons listed above for opposing section 15 would apply equally to the federal imposition of ASHRAE 62-1989.

We support a balanced approach to solving indoor air quality problems, including adequate building ventilation, proper HVAC system operation and maintenance, and source reduction inside and outside buildings, as well as additional research and information dissemination by EPA and other federal agencies.

We recommend that the Committee consider the following items as alternatives to the imposition of federal building ventilation standards.

1. Improved efforts to educate building owners, managers, and HVAC system operators through EPA guidance documents and a model training program curricula.

2. Certification of indoor air quality inspectors.

3. Increased voluntary efforts at source reduction.

4. Commissioning of HVAC systems is helpful in avoiding indoor air quality problems and should be encouraged through its inclusion in educational programs and guidance documents.

B. Product Labelling

We support the goal of providing building owners and managers with information on product contaminant emissions to help them make informed decisions on product purchases in order to reduce the emissions in their buildings. We are concerned that the product labelling provision may not be effective in achieving this goal in a meaningful way and, therfore, we do not support this provision as drafted. The bill encourage voluntary source emissions reductinon efforts by the manufacturers of the specific products listed in section 16(a) of the bill .

C. OSHA Regulations

The provision would require that OSHA duplicate the research and information efforts of EPA that are specified elsewhere in the bill which may result in inconsistent federal directives, or at least a waste of effort. The provision also could lead to unreasonably low or zero permissible exposure limits to certain substances commonly found in indoor air and may use a lesser standard of regulation than OSHA's regulatory standard of "material and significant risk". For these reasons, we oppose section 17 of the bill as drafted.

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I. Introduction

I am John Wolfert, the Director of Mechanical Engineering for Melvin Simon & Associates, Inc. a major owner and operator of shopping centers, office buildings, and hotels.

I am appearing today on behalf of eight major national real estate organizations that represent the owners and managers of shopping centers and other retail facilities and office, residential and industrial buildings: the Building Owners and Managers Association International; the International Council of Shopping Centers; the National Apartment Association; the National Association of Home Builders; the National Association of Industrial and Office Parks; the National Association of Realtors; the National Multi Housing Council; and the National Realty Committee. (Please see Appendix 1 for a description of these organizations.)

I have an associate degree in refrigeration and a mechanical engineering degree, am a registered engineer in four states, and a member of two committees of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE). I have over 35 years of experience in the design, operation and maintenance of various types of heating, ventilating, and air conditioning (HVAC) systems in over 60 commercial, industrial, and institutional buildings.

As a result of this background, I have extensive experience in commercial building HVAC systems and in preventing and solving indoor air quality problems. In addition, based on this experience, I have done an analysis of the impact of the ventilation standards provision of H.R. 1066, the Indoor Air Quality Act of 1991.

My testimony is in three parts:

- A summary of our views on the policy that the federal government should pursue in seeking to contribute to the solution to the indoor air quality problem, including the initiatives proposed in H.R. 1066;

- Our position on the new regulatory provisions in H.R. 1066 that were not contained in the bill approved by the Committee last year; and

- Our analysis of the impact of the ventilation standards provision of the bill using as examples two buildings with complex HVAC systems in locations with typical climates.

II. Federal Government Role: Solving Indoor Air Quality Problems

A. Federal, State, and Local Government and Private Activities

My experience with indoor air quality problems in various types of buildings indicates that there is much to be learned about such problems and their solutions and that there are a variety of helpful actions that government, at various levels, can take.

The central question raised by indoor air quality legislation, and particularly by the new regulatory provisions contained in H.R. 1066, is: what is the appropriate role for Congress and various federal agencies in solving indoor air quality problems?

We believe that the federal government can make important contributions in this area primarily by creating and disseminating information to building owners and managers to assist them in preventing and solving indoor air quality problems. Federal agencies are now undertaking various activities to fill this role.

The U.S. Environmental Protection Agency (EPA) has substantially increased its indoor air quality efforts in recent years. It is now working on a variety of research and educational efforts that appear very promising. For example, last year the EPA published the guidance document Managing Asbestos In Place to assist building owners and managers in dealing with the presence of asbestos in buildings. EPA expects to publish in the next few months new indoor air quality guidance documents that we believe will be very helpful in assisting building owners and managers in preventing and solving indoor air quality problems. These documents are written for commercial building owners and operators, whereas the joint EPA/CPSC guidance document The Inside Story, A Guide to Indoor Air Quality focusses primarily on the home.

Other agencies, such as the Department of Energy, the Occupational Safety and Health Administration, and the Consumer Product Safety Commission, are engaged in a number of indoor air quality activities.

State and local governments already have indoor air quality regulations in the form of building ventilation and energy codes.

Private consensus organizations, such as the American Society of Heating, Refrigerating, and Air-Conditioning Engineers (ASHRAE) which includes many real estate professionals, such as myself, also play an important role. Also, the real estate trade associations have taken a very active role in dealing with indoor air quality problems. For example, the real estate trade associations have distributed thousands of copies of EPA's guidance document, Managing Asbestos in Place, to building owners and managers in the U.S. We are working with EPA on its new indoor air guidance materials, and participating in the EPA/Industry Radon Working Group.

B. Indoor Air Quality Legislation

The indoor air quality bill approved by the Committee last year contained a number of provisions setting forth an important, and appropriate, role for the federal government in assisting in the solution to indoor air quality problems. For example, the bill provided for:

- additional indoor air quality research;

- the issuance of technology and management practice bulletins;

- the development of model building management practices training curricula;
- a study of the adequacy of ventilation standards;
- a program to deal with the indoor air quality problems in federal buildings; and
- increased funding for the EPA's indoor air quality efforts (the most important part of the bill).

Other provisions of the bill, however, would not be particularly useful, and indeed could be counterproductive. For example:

- The health advisories section is unlikely to produce significant new and useful information and could create public misperceptions about substances found in indoor air; and
- The national indoor air quality response strategy and the building assessment demonstration provisions do not appear to add to the authority of, or provide new direction for, the agencies involved and could result in inappropriate regulation or inappropriate public reaction to the presence of substances in building air.

We would prefer to see the enactment of a bill that contains those elements of last year's legislation that we believe would assist in solving indoor air quality problems, but does not contain the provisions that may be ineffective or counterproductive.

III. Position on Ventilation Standards

A. Section 15 of H.R. 1066

The real estate industry supports efforts to improve indoor air quality, including appropriate measures regarding building ventilation system design, operation, and maintenance. The industry has never opposed provisions in previous indoor air quality legislation which focussed on building systems. Indeed, the industry recommended such provisions.

Also, we have not, and do not, oppose the regulation of ventilation standards in commercial buildings (we note that neither ASHRAE 62-1989 nor the bill applies to residential facilities, including multi-family buildings). We believe that commercial building ventilation standards are, and should be, regulated by state and local building codes as is currently the case, and we support ASHRAE 62-1989 as the basic standard for consideration by building code officials in the revision of their ventilation standards. However, we do not support the adoption by the federal government of ASHRAE 62-1989 or any other national ventilation standard.

We strongly oppose the ventilation standards provision contained in section 15 of the bill for the following reasons.

1. The provision imposes very specific new regulation of building ventilation standards without the benefit of the research that the Committee, in last year's bill, decided was necessary to determine what federal government actions, if any, would be appropriate regarding such standards.

Different types of buildings have different HVAC systems with different ventilation characteristics and are subject to different market forces affecting their indoor air quality. The research section of the bill approved by the Committee last year, and still contained in H.R. 1066, recognizes these differences by directing EPA to develop methods of predicting exposure as functions of "site conditions, climate, the relative contribution of contaminants from outdoor sources, building materials and furnishings, building type, design features, use and management practices and other factors affecting exposure to contaminants."

In addition, the "ventilation program" provided in section 6(c) of last year's bill, but deleted from H.R. 1066, would have identified the ventilation standards in use, including ASHRAE 62-1989, determined the adequacy of such standards, and the extent to which buildings are operated in compliance with such standards.

The regulatory provisions of this legislation would proceed without the benefit of this research, making the research moot. They would do so without a showing that the provisions would effectively address indoor air quality problems, without regard to the differences in building characteristics recognized in the research provision or the adequacy of the current or proposed new standards. Perhaps because they were drafted before the necessary research has been completed, the regulatory provisions are simplistic and ineffective in meeting their stated goals and will have significant adverse consequences.

2. The provision imposes federal regulation in an area already regulated at the state and local level.

The provision would conflict with the regulation by state and local governments of the ventilation and energy consumption in commercial buildings which is now accomplished through the building code process. By preempting state and local code processes, the provision does not allow for the local customization of standards, which is a major advantage of the current system of standard adoption.

The current system of the development of building codes begins with the adoption of an ASHRAE standard after a long process of deliberation and debate by building experts, and then proceeds to the adoption by the American National Standards Institute (ANSI) of a standard, again after consideration by experts. The standard next is considered by the three regional code organizations, and then by the state and local code organizations where it is converted into code and ordinance language, and, most important, is customized to account for local climate, energy supply and cost conditions, and other unusual situations.

Currently, the regional code organizations are in the process of adopting the new ASHRAE standard, ASHRAE 62-1989. The general areas of influence of the various regional code organizations are shown in Appendix 2:

- The Southern Building Code Congress International (SBCCI) adopted ASHRAE 62-1989 by reference in its 1991 code.

- The Code Committee of the International Conference of Building Officials (ICBO) has approved the incorporation of the ventilation requirements of ASHRAE 62-1989 in its code and may adopt by reference the entire ASHRAE 62-1989 standard as part of its code.

- The Building Officials and Code Administrators (BOCA) will not revise their standard until 1993. During the April 1991 BOCA meeting, a proposal to incorporate parts of ASHRAE 62-1989 in the BOCA standard was not adopted because of concerns with its format. The substance of ASHRAE 62-1989 is not opposed within BOCA.

In general, after these groups adopt a standard, the state and local code organizations will consider incorporating the standard into their codes. At this stage, customization of the regional standard for unusual subregional or local climate and energy situations occurs.

Of course, private companies and organizations may adopt a new standard at any time as long as it exceeds local code requirements, and some firms, such as mine, already have voluntarily adopted applicable parts of ASHRAE 62-1989. In addition, states or cities also can adopt a new standard at any time. For example, New York State already has adopted ASHRAE 62-1989.

We strongly believe that the standards governing building ventilation should continue to be applied to buildings by states and localities after they have been developed through the current process of adoption and modification by regional building code organizations and by customization for local climate and energy factors by state and local governments.

3. The provision is significantly at variance with and more stringent than ASHRAE 62-1989 or any other ventilation standard currently in use or proposed.

ASHRAE 62-1989 provides different ventilation rates, ranging from 10 to 60 cfm/person of outdoor air, for over 80 different types of commercial facilities, and provides an alternative indoor air quality procedure that may be employed in lieu of the recommended ventilation standards.

The provision in the bill has only two standards, one for areas where smoking is not permitted (20 cfm/person outdoor air) and one for areas where smoking is permitted (60 cfm/person outdoor air with 100 percent exhaust to the outside). The ventilation requirement for areas where smoking is permitted, and where persons may or may not actually be smoking, is the rate that ASHRAE 62-1989 requires for smoking lounges, where all occupants are presumed to be smoking and where the concentration of environmental tobacco smoke would be far greater than in areas where smoking is merely permitted, but which are not designated as smoking lounges.

Both the requirement of 60 cfm/person and 100 percent exhaust for buildings in which smoking is permitted and the 20 cfm/person outdoor air requirement for nonsmoking areas are substantially in excess of ASHRAE 62-1989 requirements, current building code requirements, and the levels necessary to maintain acceptable indoor air quality in many facilities.

4. The provision would substantially increase building costs for heating and cooling and for additional boilers and chillers and other equipment.

The ventilation standards proposed in the bill would result in major energy consumption and cost increases in buildings. For example, although ASHRAE 62-1989 only would require 10 cfm/person in retail facilities, which allow smoking, the ventilation standard in the bill for such buildings would require 60 cfm/person of outdoor air with all of the air exhausted to the outside and, therefore, 100 percent outside air in the ventilation system. As a result, in the shopping center example described below, additional HVAC system equipment costs and increased heating and cooling energy consumption and cost would be very large.

In one building analyzed, the impact of increasing the ventilation areas from those prescribed in the 1973 ASHRAE standard to the rates prescribed in the bill would increase the HVAC system cost by $2.4 million and increase cooling energy consumption by 148 percent and heating energy consumption by 1147 percent for an annual increase in energy costs of nearly $500,000. In another building analyzed, the impact of increasing the ventilation rates from current code requirements to 20 cfm/person outdoor air, would increase the HVAC system cost by nearly $160,000 and increase annual energy costs $23,000.

5. The excessive ventilation requirements of the provision would result in major increases in energy consumption that would create a demand for additional electric power generation capacity and increase the outdoor air pollution resulting from the generation of such electricity.

Major increases in electricity consumption would occur in buildings subject to the standards in the bill in areas with very high or very low temperatures or very high humidity. In addition, for hot, humid locations the increased energy demand would occur during the part of the day when many electric utilities are attempting to reduce demand through time of day pricing and other means in order to avoid the need to create expensive new generating capacity.

6. The ventilation rates would be virtually impossible to achieve in many existing buildings, even if they are substantially renovated.

As described below, the physical structure of many buildings would effectively preclude meeting the standards proposed in the bill.

7. Increased ventilation would not solve all indoor air quality problems.

Even drastic and very expensive increases in ventilation rates often will not solve all indoor air quality problems. For example, many indoor air quality problems are caused by unauthorized and undocumented changes in the airflow in a building made by building tenants, such as the installation of partitions, doors, or floor to ceiling bookcases, and changes in thermostat or damper settings.

Another cause of poor indoor air quality is the improper maintenance of the HVAC system. This can occur in buildings where HVAC system operators are not properly trained and where the HVAC system operating and maintenance instructions have been lost over the years.

A third problem is the incorporation into the building of products emitting irritating or toxic contaminants. The ventilation required to eliminate these temporary emissions would be far in excess of the ventilation required for typical building conditions. In addition, some irritants in buildings, such as florescent lights, are not removed by increased ventilation.

8. The increased outdoor air ventilation requirements of the ventilation standards in the bill would degrade indoor air quality in situations where outdoor air quality is poor.

Many urban and suburban areas have suffered dramatic increases in the levels of outdoor air contaminants. Los Angeles exceeded the acceptable federal standard for ozone 148 days in 1988. In some cities, persons are advised to stay indoors on certain days because of the poor quality of outdoor air. Thus, the increased requirement of outdoor air ventilation could degrade indoor air quality in buildings in such areas.

ASHRAE 62-1989 provides alternatives to its ventilation standards that deal with the problem of poor outdoor air quality, but the bill does not.

9. The ventilation standards in the bill are unnecessary in many buildings that have adequate indoor air quality at lower ventilation rates.

As described below, many buildings with ventilation rates below those provided in the bill have acceptable indoor air quality.

10. The ventilation standards in the bill would exacerbate the energy consumption increases resulting from the recently enacted restrictions on the use of chlorofluorocarbons (CFCs).

CFCs are being phased-out and will be replaced with less energy-efficient coolants. Estimates of the increased energy costs associated with this change range from 5 to 15 percent assuming current cooling demands.

Substantially more chilling capacity will be necessary to cool and dehumidify the increased amounts of outside air required by the ventilation standards in the bill in the warm and humid areas of the country even with chillers using the more efficient CFCs. The phase-out of CFCs and the consequent use of less efficient cooling systems will make the requirements for greater chilling capacity even more expensive to meet.

11. The ventilation standards in the bill do not permit the use of an alternative indoor air quality procedure.

ASHRAE 62-1989 provides as an alternative to its ventilation standards an "Indoor Air Quality Procedure" which allows other solutions to indoor air quality problems, such as air cleaning, under a performance standard. The bill does not contain such a provision.

B. Alternatives to Section 15

1. Incorporation of ASHRAE 62-1989 in the legislation.

The incorporation by reference into the bill of ASHRAE 62-1989 would not solve all of the problems discussed above arising out of the adoption of the ventilation standards in the bill, and several of the reasons listed above for opposing section 15 would apply equally to the federal imposition of ASHRAE 62-1989.

We believe that the current system of adoption of ventilation standards which allows for local customization is the proper way to employ the ASHRAE Standard since it is wise public policy to accommodate unusual temperature, humidity, and energy supply and cost factors at the state and local level in applying ventilation standards. Creating a new federal building code for ventilation with additional federal enforcement mechanisms would impose an unnecessary layer of bureaucracy and cost that at best would be duplicative of, and at worst inconsistent with, state and local efforts. In its recent testimony before the House Committee on Energy and Commerce, ASHRAE supported the current system for adopting its standards through the code process.

2. Alternatives to Federally Imposed Building Ventilation Standards.

We support a balanced approach to solving indoor air quality problems, including adequate building ventilation, proper HVAC system operation and maintenance, and source reduction inside and outside buildings, as well as additional research and information dissemination by EPA and other federal agencies. We recommend that the Committee consider the following items as alternatives to the imposition of federal building ventilation standards.

a. Improved efforts to educate building owners, managers, and HVAC system operators through EPA guidance documents and a model training program curricula.

The draft EPA document, Preventing and Solving Indoor Air Quality Problems, generally provides very good guidance to building owners and managers in how to deal with indoor air quality concerns. It should be finalized, published, and widely disseminated to building owners and managers as soon as possible. We are working with EPA to ensure that this guidance is as useful as possible.

EPA also should issue additional, more specific, guidance regarding: HVAC system operation and maintenance; filtration methods; bacteria killing devices; the emissions of typical contaminant sources that should be minimized or avoided; proper ventilation for certain business machines, etc. Sources for this information include the maintenance recommendations of major manufacturers of HVAC system equipment.

We do not believe that the licensing of HVAC system operators would be significantly more effective than the wide promulgation of such guidance documents.

b. Certification of indoor air quality inspectors.

An EPA model certification program for indoor air quality inspectors would ensure that building owners and managers, and the occupants of their buildings, receive competent inspections of their buildings to identify indoor air quality problems.

c. Increased voluntary efforts at source reduction.

Please see the discussion of product labelling below.

d. Commissioning of HVAC systems is helpful in avoiding indoor air quality problems and should be encouraged through its inclusion in educational programs and guidance documents.

ASHRAE Guideline 1-1989, Commissioning of HVAC Systems, generally includes appropriate guidance regarding HVAC systems, and appropriate parts of it are often used by building owners. The Guideline should not be required by regulation and, in fact, it would not be practical to do so. However, information about the Guideline should be included in indoor air guidance documents published by the federal agencies.

IV. Product Labelling

We support the goal of providing building owners and managers with information on product contaminant emissions to help them make informed decisions on product purchases in order to reduce the emissions in their buildings. However, we are concerned that the product labelling provision may not be effective in achieving this goal in a meaningful way. In addition, the inclusion of the large number of products that contain solvents appears to be excessively broad. Therefore, we do not support Section 16, the product labelling provision, as drafted.

One way to reduce source emissions in buildings that the Committee may want to explore is exemplified by the voluntary EPA carpet dialogue process which has produced agreement by the carpet manufacturers on a reduction in emissions from carpets. The Committee may want to encourage similar voluntary efforts by the manufacturers of other building materials, including the manufacturers of the specific products listed in section 16(a) of the bill. Where voluntary dialogues already have begun, they should be encouraged to complete their work as soon as possible.

V. Building Ventilation Systems and the Impact of Increased Ventilation Standards

In considering ventilation standards and their impact on building energy consumption and costs, one must understand the major elements of a complicated building HVAC system, the factors affecting indoor air quality in a building, the need for additional ventilation in specific types of buildings, and the energy and cost implications of increasing outdoor air requirements. Building HVAC systems and these issues are described and discussed here and in Appendix 2.

In addition, to illustrate the impact of the proposed ventilation standard, we have analyzed the impacts on a typical regional shopping center and an office building of increasing ventilation to the levels required by the bill and the consequences of imposing such a requirements.

A. More Stringent Ventilation Standards Are Unnecessary.

Enclosed shopping centers have more complex central HVAC systems than perhaps any other type of commercial building, with: 1) a complex central HVAC system for the common areas of the mall (including most of the system elements described in Appendix 3); 2) similar central HVAC systems for most larger and some smaller tenants; and 3) decentralized roof mounted systems (which may or may not have outdoor air intakes) for smaller tenants. Large office buildings have similarly complex centralized HVAC systems, but do not also have decentralized systems.

Shopping centers and well-run office buildings have not been identified as buildings with indoor air quality problems or with inadequate ventilation that would benefit from more stringent ventilation standards than those already in place. This is due to the designs of the buildings and the market forces that require owners and managers to maintain indoor air quality that is pleasing to those using their buildings.

Shopping centers and mixed-use buildings generally have relatively large amounts of outdoor air infiltrating into them through their many doors, none of which are revolving doors because of the difficulty carrying packages through them. Shopping centers also have relatively large amounts of ventilation air distributed to all parts of the building to remove the substantial heat generated by the lights necessary to provide the level of desired illumination, and ventilation problems usually result in excessive temperatures (where 2 or 3 degrees above optimum is considered a problem) at ventilation rates greater than those required to maintain adequate air quality. Mixed-use buildings and certain office buildings share many of these same characteristics, especially where large window areas admit large amounts of solar radiation into the building in the summer and allow substantial amounts of heat loss in the winter and the ventilation system must provide large amounts of supply air to maintain the desired temperature.

Market forces are equally important in determining the indoor air quality in buildings. Shoppers are volunteers and they are not required to go to a particular shopping center. Therefore, because of the vigorous competition among shopping centers and other retail stores, owners cannot afford to allow indoor air problems to discomfort their customers. Well-run office buildings are subject to similar market pressures and tenants demands for high quality indoor air, and this guarantees that their indoor air quality is maintained in a state acceptable to the users of their buildings.

Government office buildings may be at the opposite end of the spectrum of market forces because tenants have little leverage to force improvements. Therefore, on average such buildings may have lower indoor air quality than private sector buildings.

B. Impact of the Ventilation Requirement.

The bill would require that building owners ventilate with 60 CFM/person of outdoor air with a 100 percent exhaust from the entire building, thereby requiring 100 percent outdoor air, in areas where smoking is allowed. This requirement is absurdly high, grosslyly unnecessary to maintain acceptable indoor air quality, wasteful of energy, and very expensive.

ASHRAE 62-1989 sets a ventilation rate for shopping centers equal to the level set in the 1981 standard for areas where smoking is permitted (an equivalent of 10 cfm/person, based on a requirement of 0.2 cfm/sq. ft. at an assumed maximum of 20 persons per 1000 sq. ft.). Office building reception areas should receive 15 cfm/person of outdoor air under ASHRAE 62-1989.

1. Shopping Center Impact.

The consequences of going from the 10 cfm/person requirement provided in ASHRAE 62-1989 to the 60 cfm/person proposed in the bill have been estimated for a 530,000 square foot regional shopping center located in St. Louis, Missouri. This shopping center is currently operated at a ventilation rate 0.2 cfm/sq.ft. of outdoor air as provided in ASHRAE 62-1989 and has no indoor air quality problems. The bill would require 1.2 cfm/sq.ft. of outdoor air. The applicable building code requires 0.1 cfm/sq.ft. The impacts of increasing the ventilation rate from the current code requirement, which is the standard contained in ASHRAE 62-1973, to the ASHRAE 62-1989 requirement and of increasing the ventilation rate from the ASHRAE 62-1989 requirement to the rate required by the bill are summarized below and analyzed in detail in Appendix 4.

As this analysis shows, the impacts on the HVAC plant required, energy consumption and energy cost are substantial when the ventilation rate is increased from the 1973 to the 1989 ASHRAE Standard, and these impacts are enormous when the ventilation rate is increased to the standard proposed in the bill.

From the 1973 to the 1989 ASHRAE Standard:

- Required cooling plant capacity increases 13 percent and heating plant capacity increases 77 percent, resulting in an increased construction cost of $202,330, a 4 percent increase in HVAC system cost.

- Annual cooling electricity consumption increases 13 percent and annual heating energy consumption increases 56 percent, resulting in an annual increase in energy costs of $34,899, an 18 percent increase in annual heating and cooling energy cost and a 3 percent increase in total building energy costs.

From the 1973 ASHRAE Standard to the ventilation standard in the bill:

- Required cooling plant capacity increases 148 percent and heating plant capacity increases 892 percent, resulting in an increased construction cost of $2.4 million, a 44 percent increase in HVAC system cost.

- Annual cooling electricity consumption increases 148 percent and annual heating energy consumption increases 1147 percent, resulting in an annual increase in energy costs of $493,475, a 247 percent increase in annual heating and cooling energy cost and a 48 percent increase in the total building energy cost.

Even for buildings where smoking is not permitted, the bill would require twice the amount of outdoor air for shopping centers and 50 percent more for office building reception areas as specified in ASHRAE 62-1989. Although this requirement would have a less severe impact than imposing the six-fold ventilation increase described above, it still would be unnecessary, wasteful of energy, and unnecessarily expensive.

2. Office Building Impact

For a 200,000 sq. ft. office building in Washington, D.C., that is presently ventilated in accordance with local code requirements at 5 cfm/person of outdoor air and which has no indoor air problems:

- Required cooling plant capacity increases 12 percent and heating plant capacity increased 5 percent, resulting in an increased construction cost of $159,000, a 7 percent increase in total HVAC system cost.

- Annual cooling electricity consumption increased 15 percent and annual heating energy consumption increases 15 percent, resulting in an annual increase in energy costs of $23,154, a 15 percent increase in annual heating and cooling energy costs and a 7 percent increase in total building operating costs (including energy costs, and all salaries and other costs for building operations and maintenance activities).

C. Other Studies on the Impact of the Ventilation Standards.

We understand that studies have been done that suggest that there is only a minor energy cost increase cost associated with increasing ventilation rates. A study cited in ASHRAE's testimony before the House Committee on Energy and Commerce reviewed the cost impact on 13 office buildings in the U.S. and Canada of increasing ventilation rates from 5 to 20 cfm/person.

The study noted that this increase would "significantly affect equipment-sizing." This means the purchase of larger and more expensive heating and cooling equipment, which because of size may not be able to fit into an existing building. This study is consistent with our findings about the need for additional heating and cooling equipment to meet the ventilation standards of the bill.

The study cited by ASHRAE concluded that the increased ventilation rate would have only a small increase on total annual energy operating costs (less that 5 percent), because most electricity is used for lights rather than air conditioning.

It is important to note the most significant impact of the bill is caused by increasing ventilation from 10 or 20 cfm/person to 60 cfm/person in buildings where smoking is permitted. Energy consumption is not a linear function of outdoor air ventilation rate.

It also is important to note that a 5 percent energy cost increase is not a minor matter. Energy expenses are a significant part of total building operating expenses and even a five percent increase that is not justified results in a significant waste of economic resources and a significant increase in demand for electric power generating capacity.

Many buildings in operation today were built after the energy crisis of the early 1970s and were designed for the ventilation rates then specified in ASHRAE 62-1973, which are much lower than those specified in ASHRAE 62-1989. These buildings cannot simply open their dampers and admit more outside air. Even those buildings that have systems capable of substantially increasing outdoor air ventilation would incur major increases in costs which are not justified by a need to avoid indoor air quality problems.

D. Retroactivity.

The impact of the retroactive application of a ventilation standard would range from: 1) no additional cost where a building is already operated at the standard; 2) additional (and perhaps substantial and unjustifiable) energy costs, but no additional capital cost, where a building is designed to, but is not operated under, the standard; 3) very large additional energy and capital costs where the building ventilation system is not capable of meeting the standard.

In hot and humid or cold locations it is likely that the ventilation standards of the bill would require a substantial increase in cooling or heating capacity that could require structural changes to provide space for new boilers, chillers, pumps, hot or cold water pipes, condensers, etc. This would entail a substantial cost to the building owners and tenants.

VI. OSHA Regulations

The Occupational and Safety and Health Administration (OSHA) already has the authority to regulate indoor air contaminants, and we understand that OSHA has issued a request for information regarding indoor air quality as a prelude to the possible initiation of a rulemaking proceeding. We therefore believe that section 17, which requires OSHA to consider specified regulatory provisions, is unnecessary.

In addition, we are concerned that section 17 of the bill appears to require that OSHA duplicate the research and information efforts of EPA that are specified elsewhere in the bill. This presents the possibility of inconsistent federal directives, or at least a waste of effort.

Moreover, the bill requires OSHA to consider regulations to "provide protection from cumulative, synergistic, or combination effects of indoor air contaminants...". This requirement, combined with the finding that some persons "may have heightened sensitivity to chemicals and related substances found in the air indoors" could lead to unreasonably low or zero permissible exposure limits to certain substances commonly found in indoor air. Any requirement that OSHA consider indoor air regulations should make clear that OSHA's regulatory standard of "material and significant risk" remains in force and that the regulations should not apply any lesser standard.

For these reasons, we oppose section 17 of the bill as drafted.

VII. Conclusion

The demands of the marketplace -- quality-conscious tenants, competing properties, and cautious lenders and insurers -- require that state of the art management practices be employed in today's buildings, including the maintenance of a very high standard of indoor air quality. Building owners and managers are well aware of how important high quality indoor air is to those who pay the rent, lend the money, and write the insurance coverage for the building.

We support efforts of the federal government to assist building owners and managers in preventing and solving indoor air quality problems by performing additional indoor air quality research and disseminating the results of that research in the form of guidance materials and model educational programs, and increased EPA funding for these activities. We also support federal government sponsorship of government/industry policy dialogues to devise workable voluntary means of reducing contaminant sources.

We oppose the creation of duplicative and potentially inconsistent efforts either among federal agencies or between the federal government and units of state and local government. Specifically, we oppose the enactment of federal ventilation standards that would override state and local regulatory procedures which produce ventilation standards appropriate for their local circumstances, and we oppose the product labelling and OSHA rulemaking provisions as drafted.

APPENDIX 1

This testimony is submitted by the following national organizations which represent those individuals and firms that develop, own, operate, and finance income-producing real estate. These organizations are:

> The Building Owners and Managers Association, International (BOMA): BOMA is the oldest and largest trade association representing the office building industry, with 100 Federal Associations in the United States, Canada, and around the world. BOMA has 6,800 members who are office building developers and owners and managers who own or manage 5 billion square feet of office space in North America. BOMA is headquartered at 1201 New York Avenue, N.W., Suite 300, Washington, D.C. 202/408-2662.
>
> The International Council of Shopping Centers (ICSC): ICSC is the trade association of the shopping center industry. Members of ICSC, consisting of shopping center developers, retailers, investors, managers, and others having a professional or business interest in the shopping center industry, are engaged in the day-to-day activities of designing, planning, construction, managing, financing, developing, leasing and owning shopping centers and their retail stores. ICSC has approximately 27,000 members, and the approximately 25,000 located in the United States represent a majority of the shopping centers in this country. ICSC is headquartered at 665 Fifth Avenue, 11th Floor, New York, New York. 212/421-8181.
>
> The National Apartment Association. NAA is the only industry-wide, non-profit trade association devoted solely to the needs and problems of the multihousing industry. The NAA is a federation of local and state associations of owners, builders, investors, developers and managers of multihousing properties. The NAA represents the interests of more than 200,000 multihousing professionals nationwide. NAA members own and manage over 3.5 million apartments and condominiums. NAA is located at 1111 14th Street, N.W., Washington, D.C. 202/842-4050.
>
> The National Association of Home Builders. NAHB is known as the "voice of the housing industry" and represents 155,000 member firms involved in all phases of the residential and light commercial construction industry. Headquartered at the National Housing Center, NAHB has more than 800 affiliated state and local associations around the country. During a typical year, NAHB members employ millions of americans and generate billions of dollars in tax revenue in an industry that accounts for about five percent of the nation's gross national product. NAHB offices are located at 15th and M Streets, N.W., Washington, D.C. 202/822-0200.

The National Association of Industrial and Office Parks. NAIOP represents over 7,000 companies who develop, own and operate industrial, office and retail properties in the U.S. and Canada. Working with the national office, NAIOP's 69 U.S. chapters stress research, education and public policy advocacy in achieving their goal of creating a better quality of life. NAIOP is headquartered at 1215 Jefferson Davis Highway, Suite 100, Arlington, Virginia. 703/979-3400.

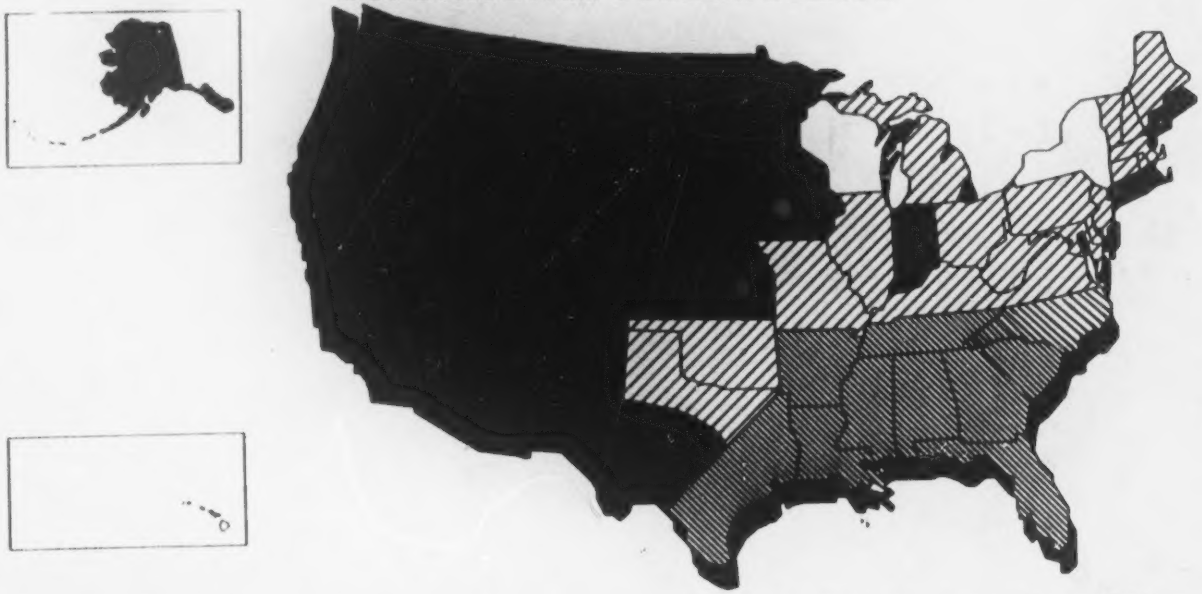
The National Association of Realtors. NAR is the nation's largest trade and professional association with nearly 800,000 members in 50 states, Guam, Puerto Rico, the District of Columbia and the Virgin Islands. NAR's membership is composed of REALTORS, who are generally brokers or salespeople, and REALTOR-ASSOCIATES, a membership category made up largely of salespeople. Working for America's property owners, NAR provides a facility for education, research and exchange of information among its members and to the public and government for the purpose of preserving the free enterprise system and the right of free people to own real property in the interest of public welfare. NAR is located at 777 14th Street, N.W., Washington, D.C. 202/383-1087.

The National Multi Housing Council. NMHC represents the interests of the larger and most respected firms in the United States participating in the multifamily rental housing industry. The members of NMHC are engaged in all aspects of the development and operation of rental housing, including the ownership, building, financing, management, and conversion to condominium or cooperative ownership of such properties. NMHC is headquartered at 1250 Connecticut Avenue, N.W., Suite 620, Washington, D.C. 202/659-3381.

The National Realty Committee. NRC represents the nation's leading developers, owners and financiers of income-producing real property. Its members include individuals and firms that design, plan, develop, lease, own, operate and finance income-producing real property, including office buildings, shopping centers, industrial buildings, warehouses and apartment buildings. NRC is headquartered at 1250 Connecticut Avenue, N.W., Suite 630, Washington, D.C. (202) 785-0808.

APPENDIX 2

MAP OF GENERAL AREAS OF BUILDING CONSTRUCTION CODE INFLUENCE*



■ ICBO Uniform ▨ BOCA Basic/National ■ SBCCI Standard ☐ State-written

Source: 1989 Directory of Building Codes & Regulations, Volume 1 - Code Primer
NCSBCS, 481 Carlisle Dr., Herndon, VA 22070; (703) 437-0100.

* Verify information with state or local building departments

Many areas use different codes for other construction areas.

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APPENDIX 3

I. Building Ventilation Systems

Complex building ventilation systems contain the following elements:

- An "outdoor air intake" with "dampers" that adjust the amount of "outdoor air" taken into the HVAC system directly;

- a duct to conduct the outdoor air from the outdoor air intake, often located on the roof of the building, to the HVAC system, usually located in the basement;

- an "air mixer" that combines outdoor air with "return air" from the building;

- "boilers" and "heat exchangers" to heat, and "chillers", "cooling towers", "pumping stations", to cool and dehumidify the mixed air;

- an "air-cleaning" system, such as filters, to reduce concentrations of airborne contaminants;

- a "supply air" duct and "diffuser" system, that takes the supply air to the occupied parts of the building;

- "ventilation air", the mixture of outdoor air and recirculated air that has been treated to remove contaminants;

- local thermostats and "variable air volume" (VAV) mixer boxes that mix conditioned supply system air with "recirculated room air" and add heat to the air for individual room temperature control;

- an "economizer system" that mixes more outdoor air with building air when the outdoor air temperature is low to reduce cooling costs;

- a "return air" ducting system, including "plenums" over suspended ceilings, to return air to the central HVAC system for conditioning and recirculation;

- "exhaust air", e.g., that is exhausted from bathrooms, kitchens, blueprint rooms, smoking lounges, etc. to the outdoors, is not recirculated, and is be replaced by makeup air;

- doors, regular and revolving, operable windows, and cracks around doors and windows and other leaks which provide natural ventilation through "infiltration" and "exfiltration".

There are a wide variety of building heating, ventilating, and air conditioning (HVAC) systems which vary in their complexity, cost, and ability to change the amount of outdoor air brought into the building.

The simplest system is used in the typical single family home. All outdoor air is infiltration from opening doors or windows, and from cracks around doors and windows and other building leakage. The HVAC system recirculates building air and heats, cools, humidifies or dehumidifies it, but does not directly intake outdoor air.

This same system is employed in many apartments (where there is likely to be a central hot and cold water generating plant), but all air handling functions are done in individual units as in a single family home.

Similar systems are found in the individual stores in most strip shopping centers, and these may include direct outdoor air intakes into the decentralized HVAC systems.

A more complicated system is the centralized system which includes all of the elements described above. This system is typically in use in modern office buildings.

The most complicated system is a mixture of centralized and decentralized elements. This system is found in some large shopping malls.

II. Factors Affecting Indoor Air Quality

A large number of factors affect the indoor air quality in a building, including:

- the number of persons per square foot and their level of physical activity;

- whether smoking is permitted and how many persons are actually smoking;

- the amount of total ventilation delivered in each occupied space;

- the amount of outside air from all sources in the occupied spaces;

- the sources of contaminants within the building, such as carpeting and other furnishings

- the operation and maintenance of the HVAC system,

- the amount and efficiency of air-cleaning activities, such as the efficiency of filtration, the frequency of filter change, including local room air filtration and plants;

- the temperature, humidity, and quality of outdoor air, and the location of outdoor air intakes and their proximity to outdoor air contaminant sources.

III. Need For and Implications of Increasing Outside Air

In many buildings, the amount of outdoor air circulated in the building is more than adequate to maintain adequate indoor air quality, given the factors described above, and there is no need to increase the amount of outdoor air into the HVAC system. For example:

> Buildings with many doors, especially non-revolving doors which permit substantial air infiltration, can be effective in providing outdoor air to building occupants, particularly where the doors are located throughout the building in proximity to most building occupants. Such buildings can provide sufficient outdoor air to occupied spaces with little or no intake of outdoor air directly into the HVAC system.
>
> Buildings with high heat loads, including those with many lights, require substantial amounts of outdoor air to keep the building cool and this air circulation is more than adequate to maintain indoor air quality.
>
> Buildings, such as well-run office buildings and shopping centers, where competition and other market forces require building owners and managers to maintain a high quality building environment do not have indoor air quality problems.

The difficulty and cost of increasing the amount of outdoor air in an existing building depends on the configuration of the HVAC system and the building and the climate in which the building is located (i.e., outdoor air temperature, humidity, and solar radiation). Where the outdoor air intake is on the roof and the outdoor air duct runs through each floor to the basement, in many cases it will not be possible to increase the size of the outdoor air duct. Where building height restrictions have resulted in limited above ceiling space and small ducts, increases in ventilation also would be very difficult.

Increasing the amount of outdoor air in buildings could reduce indoor air quality in some buildings by reducing total ventilation. For buildings that only exhaust through bathrooms, additional outdoor air intake may require the installation of a new building exhaust system. Otherwise, if less building air is recirculated, there will be less draw on the return air, less pressure differential between the rooms and the supply air, and consequently less supply airflow.

APPENDIX 4

OUTDOOR AIR VENTILATION STANDARDS 05/06/91

Based on: Retail Shopping Center
Small Tenant Spaces & Public Mall
St. Louis Centre
St. Louis, MO

	1973 Std.	1989 Std.	Prop. Std.
A:-Air Quantities Required:			
-Supply Air-CFM	647,149	647,149	647,149
-Outdoor Air-CFM	53,045	106,090	647,149
-Percent OA	8%	16%	100%
B:-Cooling Plant Required:			
-Capacity Tons	1827	2068	4526
-Percent Increase		+13%	+148%
C:-Heating Plant Required:			
-Capacity MBH	4960	8795	49,226
-Percent Increase		+77%	+892%
D:-HVAC Construction Cost:			
-Central HVAC System	5,380,374	5,582,704	7,756,800
-Tenant Finish	812,867	812,867	812,867
-Total	6,193,241	6,395,571	8,569,667
-Percent Increase		+3%	+38%
E:-Annual Energy Consumption:			
-Light & Power-Tenants	7,424,065	7,424,065	7,424,065
-Light & Power-Mall	3,343,843	3,343,843	3,343,843
-HVAC Distribution	2,324,962	2,324,962	2,324,962
-Cooling Plant	2,835,804	3,209,749	7,025,358
-Total Electric-KWH =	15,928,674 KWH	16,302,619 KWH	20,118,228 KWH
-Percent Increase		+2%	+26%
-Heating Plant-Therms.=	39,883	62,408	497,188
-Percent Increase		+56%	+1147%
F:-Annual Energy Cost:			
-Light & Power-Tenants	$ 469,275	$ 469,275	$ 469,275
-Light & Power-Mall	211,364	211,364	211,364
-HVAC Distribution	146,961	149,961	146,961
-Cooling Plant	179,251	202,888	444,073
-Heating	19,941	31,203	248,594
-TOTAL	$1,026,792	$1,061,691	$1,520,267
-Percent Increase		+3%	+48%

Mr. **Scheuer**. Thank you very much, Mr. Wolfert.

Now we'll hear from Dr. Alan Hedge, Cornell University, Department of Design and Environmental Analysis. Please proceed, Dr. Hedge.

Dr. **Hedge**. Good afternoon, Mr. Chairman, and members of the committee.

My name is Alan Hedge. I'm a professor at Cornell University, and for over the past ten years I have been investigating problems of what now are called "sick" buildings.

What I want to do is share with you some of the results from those studies and also to caution you about some of the contents of the indoor air quality legislation that you're proposing as it stands. But I want to say at the outset that I wholeheartedly support the idea of developing an indoor air quality act. I believe, however, that act should try and reflect the current state of our scientific knowledge and not the information that is in the Act, in section 15 in particular.

The first thing to recognize is that when we're dealing with air quality problems in buildings, in fact, we're dealing with human problems. We're looking at the health of people in buildings. And here it's important to distinguish belief and fact. We believe that many of the health problems people report may be related to air quality. The fact is that we have no good research evidence to show that for most buildings in which there is a high prevalence of complaints.

The second thing is that it's important to distinguish between different types of health problems that people may have. We have much better evidence when looking at life-threatening illnesses such as lung cancer, or infectious diseases such as Legionnaires disease, we have much better evidence that links exposure to the health problem than we do when we look at the kinds of complaints that one finds in many buildings. These complaints have come to be known as "sick building syndrome" and they deal with a range of irritation and discomfort symptoms that people report. Sick building syndrome is not life threatening, as far as we know, but as a syndrome, it is also not well defined. And when you look at the research literature, there is considerable confusion as to what constitutes a health problem in these buildings.

We have no consensus on the range of health complaints, on the frequency of complaints, or really on the etiology of complaints in buildings. I think it's important to recognize that at some point. In fact, most studies of indoor air quality in buildings actually exclude mentioning or even measuring anything about the people in buildings. We implicitly assume that the lower the level of pollutants that we can create, the healthier people will be.

In terms of section 15, the assumption there is that increasing the ventilation rate—that is, dilution ventilation—in itself will resolve the complaints that people report in buildings. The research evidence suggests that people in naturally ventilated buildings often are healthier than people in air-conditioned buildings, and yet the dilemma is that people in naturally ventilated buildings have much lower ventilation rates than those in air-conditioned buildings.

It seems rather ironic that the ASHRAE standard was revised on the basis of no controlled research study. I can't think of another situation in which we might, for example, introduce a new drug on to the marketplace. We would always conduct some kind of controlled field trials to show that that drug was or was not effective. But I've been unable to find any controlled studies that demonstrate that increasing the ventilation rates in air-conditioned buildings actually bring about reductions in the kinds of sick building syndrome complaints that I'm talking about. Or even that increasing the ventilation rate substantially improves indoor air quality and that that, in turn, has an effect on people.

The ASHRAE Standard 62-89 does not seem to be a health-based standard, as far as I can see. I'm assuming, therefore, that it's a comfort-based standard or a belief-based standard.

It seems to me that there is a need for an integrated strategy in any bill, rather than prescribing a specific ventilation rate. That strategy should recognize that there may be a role for dilution ventilation, providing certain conditions are met. Those conditions are that, first of all, the outdoor air should be—I'll use the term "clean". Because if we bring contaminated outdoor air into a building, then the more we bring in, the worse the problem may be.

Secondly, we need to consider issues of source control and localized filtration technologies in buildings, and thirdly, we need to consider how products that go into buildings are actually used. That's where I see section 16 has rather a gap in it. We're concerned usually not with just emissions but how a product is used in a building and how that product is maintained, because that's where contamination can occur.

My final comments are on the last section, 17, on the worksite analysis. Almost all studies of sick buildings show that air quality meets current industrial hygiene standards. I believe that industrial hygiene approaches, as they presently stand, are inadequate. We need to study the occupants in greater detail and to understand the spacial distribution of problems in buildings, because buildings are spacial systems. To that end, I'm working with the American Standards for Testing and Materials Society to develop a standard to enable people to conduct occupant surveys of their buildings.

I would like to thank you for the opportunity for providing brief testimony today.

[The prepared statement of Dr. Hedge follows:]

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Statement and Comments on

H.R.1066 "INDOOR AIR QUALITY ACT OF 1991"
Sections 15,16,17

Presented to
SUB-COMMITTEE ON ENVIRONMENT

by

Alan Hedge, Ph.D.
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April 29, 1991

SUMMARY OF COMMENTS

1. Evidence on the effects of indoor air quality on occupant health shows that dilution ventilation, achieved by increasing ventilation rates, may not significantly benefit indoor air quality and does not resolve many of the complaints comfort and health complaints in buildings. In part this is because the HVAC system itself can be the source or carrier of a number of indoor air contaminants. The Act should recognize the limitations of this traditional view of indoor air quality concerns, and it should also reflect current research.

2. The Act should acknowledge the emerging environmental technologies which compliment HVAC operations, such as localized breathing-zone filtration systems, e.g. Airflow 2000 system (Centercore), which provide cost-effective mitigation of many indoor air quality problems. Breathing-zone filtration(BZF) is a form of source control which compliments dilution ventilation by localized air filtration in each worker's breathing zone (the air layer 30 - 84 above level). In current BZF products each worker is continuously supplied with clean air which has passed through 3 filtration systems to remove fungal spores, bacteria, larger viruses and other micro-organisms, dust mite feces and other insect debris, environmental tobacco smoke and other particulates, mineral fibers including asbestos, attached radon and attached radon progeny, and volatile organic compounds.

3. The Act should include a requirement to standardize diagnostic procedures for investigating indoor air quality complaints in buildings. It is suggested that this procedure should be stepwise, that it should include a questionnaire survey of occupants, that there should be assessment of indoor air quality, and that spatial analysis of questionnaire survey results should be undertaken to pinpoint problems areas in buildings.

VENTILATION STANDARDS FOR PUBLIC OR COMMERCIAL BUILDINGS

Section 15(a) NEW BUILDINGS

Comments on PAGE 52 lines 3 through 12

This part of the Act states that all new buildings shall have an HVAC system designed to provide a minimum of 20 cubic feet per minute of outdoor air per occupant (cfmpp), and a minimum of 60 cubic feet per minute of outdoor air per smoking occupant to rooms where smoking is permitted. This conforms with the recommendations of ASHRAE 62-1989. The Act should acknowledge, however, that there is no empirical evidence that these ventilation provisions will improve the health of the occupants, in fact the reverse may be the case. There is a paucity of research on the effects of intervention to increase ventilation rates or the outdoor air content of supply air. Of the research which has been conducted, results have been remarkably consistent. Research has shown that there is either no effect of increasing outdoor air supply from 25% to 100% on worker's health reports [1], or a very small effect of increasing outdoor air supply from 25% to 100% on workers' health reports [2]. Similarly, research has shown that reports of symptoms associated with poor indoor air quality, often termed sick building syndrome (eye, nose and throat irritation, headache, lethargy, skin irritation, breathing difficulty), can increase with increasing ventilation supply from 20 cfmpp to 45 cfmpp [3]. Increasing the ventilation rate from 16.5 cfmpp to 38 cfmpp also slightly increases occupants complaints of thermal comfort, odors, and dust and has no measurable effect on indoor air pollutants (carbon monoxide, carbon dioxide, formaldehyde, nicotine, respirable particulates) [4].

There are a number of reasons why it is misleading to believe that increasing the ventilation rate will either beneficially affect occupants or indoor air quality.

1. If the HVAC air is contaminated by outdoor sources, e.g., the bacterium *Legionella pneumophila* from cooling mists, carbon monoxide and hydrocarbons from automobile exhausts, nitrogen and sulfur oxides from combustion processes, etc., then increasing the air supply simply will increase the delivery of contaminants to occupants.
2. There is a growing body of evidence that the HVAC system itself can be the source of a large number of contaminants. The HVAC system can generate levels of volatile organic compounds (VOCs) four times greater than those emitted by finishes and furnishings within the office [5]. The growth of micro-organisms, especially fungi and bacteria, can occur inside the HVAC ducts and filters, especially when these ducts are lined or become damp [6,7].
3. Many indoor air contaminants are released directly in the office space, e.g.,

mineral fibers from acoustic ceilings, dust mite feces in carpets and material surfaces, ozone from office technology such as laser printers, viruses and bacteria from people, etc. Increasing ventilation rate will not proportionally increase the effective removal of these non-gaseous contaminants in buildings.

4. Most office spaces have systems furniture with panels which can interfere with air flow around the office. Ceiling delivery systems cannot effectively deliver clean air or create adequate air mixing in the breathing-zone of each worker, i.e. the vertical stratum of air from 30-84 inches above level, because of inevitable short-circuiting of airflow over the top of the panels. A floor delivery system overcomes the problems of short-circuiting but the floor to ceiling airflow may increase the transportation of any contaminants from office carpets to the occupants.

There is substantial research evidence that symptoms of sick building syndrome are considerably higher in air-conditioned buildings than in naturally ventilated buildings [8,9]. For the reasons briefly outlined, it is recommended that the Act should not prescribe the installation of an HVAC system in new construction nor mandate the ventilation rates for an HVAC system.

Comments on PAGE 12 lines 12 through 14

The Act proposes that where smoking is permitted in buildings, this shall be restricted to rooms which have separate exhaust ventilation. This is an unnecessary stipulation. Research studies have shown that there is no difference in indoor air quality between the non-smoking office areas in buildings with separately ventilated smoking rooms compared to those without any separate exhaust ventilation in the smoking rooms [10,11]. Any significant risk to a non-smoker will be from direct exposure to environmental tobacco smoke (ETS) in the vicinity of the smoker, and this will still happen if a non-smoker enters a separately ventilated smoking room. Prohibiting smoking in a building also does not significantly reduce sick building syndrome complaints [11]. The use of a localized breathing-zone filtration system either in a smoking room, or preferably within the office itself should mitigate the effects of ETS on non-smokers.

CONTAMINANT EMISSIONS PRODUCT LABELING

Section 16(a) MEASUREMENT STANDARDS AND PRODUCT LIST

Comments on PAGE 56 lines 6 through 8

This part of the Act states that products which pose a significant adverse health threat through indoor air contamination emissions shall be identified. Clarification of the term "significant adverse human health threat" is required. Many of the health problems, e.g. sick building syndrome as defined by the World Health Organization [12], which are associated with occupancy of buildings are irritative symptoms which are alleviated when the affected person is away from the building. For this reason it could be argued that sick building syndrome is not a significant adverse human health threat. The Indoor Air Quality the Act clearly should address problems such as sick building syndrome.

Comments on PAGE 56 lines 9 through 15

The tone of this part of the Act emphasizes contamination by gaseous emissions from a number of products, but there is no mention of problems of particulates, mineral fibers, and microbiological contaminants associated with certain products, e.g., many kings of acoustic ceiling tile can shed irritating man-made mineral fibers into the indoor environment, and if the tile becomes damp it can also support the growth of fungi. Additional clarification of the scope of product emissions is required.

This part of the Act should also address the potential for contamination which can arise without proper installation and/or cleaning and maintenance of "safe" products, e.g. problems can arise with products such as "healthy" carpeting if this is incorrectly installed with organic solvent-based rather than water-based adhesive, and if this is poorly cleaned so that dirt, which may contain pollutants, such as pesticides, accumulates or provides a substrate for the growth of microorganisms.

WORKPLACE INDOOR AIR QUALITY PROTECTION

Section 17(b) STANDARDS (1) WORKSITE ANALYSIS

Comments on PAGE 60 lines 1 through 3

This part of the Act requires comprehensive evaluations of contamination and other causes of poor indoor air quality. Because of the poor fit between current industrial hygiene measurements of indoor air quality and the health complaints of occupants, it is important that any comprehensive evaluation shall include an occupant survey to determine the nature and prevalence of adverse health reports. The American Standards for Testing and Materials has prepared a draft standard for conducting such an occupant survey (ASTM Subcommittee E6.25, 1991). The health of the occupants of the building is an excellent integrated measure of whether or not there may be an indoor air quality problem in the building. Spatial analysis of the distribution and pattern of reported health problems in a building can help to diagnose whether or not problems are localized, and can pinpoint areas and potential sources for detailed evaluation [13], and this should be recommended.

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Mr. **Scheuer**. Thank you very much for your very interesting testimony.

Now we'll hear form Arthur Wheeler, a building engineer from Towson, MD. Please proceed, Mr. Wheeler.

Mr. **Wheeler**. Mr. Chairman, this testimony is based upon my knowledge as a professional engineer, with responsibility for the design of heating, ventilating and air conditioning systems for a wide variety of buildings over a period spanning 40 years.

I am a fellow and a member of ASHRAE, and a member of the ASHRAE Standard Project Committee that produced Standard 62-1989, and conduct professional development seminars for ASHRAE on indoor air quality throughout the country.

The purposes of the Act are essentially sound, in my view, and consistent with the continuing well-founded efforts of the Environmental Protection Agency and other Government agencies towards expanding our knowledge of building air quality through research, through education, and through collaboration with manufacturers of building materials and furnishings.

Two changes could make this program more effective. One is the strengthen the authority of EPA within the Interagency Committee on Indoor Air Quality to assure efficient, coordinated progress of the program. The second would be to adopt more realistic objectives for asbestos and radon control that are consistent with current scientific assessments of risk.

The primary object of my testimony is directed at the ventilation standards for public or commercial buildings, sections 15 and 16, and the enforcement provisions of section 17. These sections are poorly crafted. The proposed ventilation rates of 20 cfm of outdoor air per occupant and 60 cfm of outdoor air per smoking occupant are arbitrary and unsupported by the new ASHRAE standard. In a curious paradox, it requires new buildings to be tight, thereby reducing the true ventilation rate. This tightness requirement virtually mandates that all buildings throughout the country be air conditioned.

These requirements would have substantial impact, increasing energy use, especially in schools, theaters, restaurants, shopping centers, not to mention office buildings. Also increased would be energy demand for heating and cooling, thus taxing electrical generating and distribution capacities. Increased energy use exacerbates atmospheric pollution by increasing emissions of carbon dioxide and sulfer dioxide from heating and electrical generating plants. Moreover, the construction cost for heating and cooling capacity is substantially increased for some building types, such as schools, inhibiting new construction and rehabilitation of existing facilities.

Wintertime ventilation with excessive amounts of outdoor air with low moisture content can actually reduce the healthful qualities of the building environment by reducing the relative humidity.

The very premise that increased ventilation by outdoor air will solve indoor air quality problems—which are far more often comfort related than disease causing, and which, in fact, occur in only 20 percent of our buildings—is tragically oversimplistic. Outdoor air is useful for diluting contaminants generated within the buildings. It is secondary as a means of control only to source control, which, where practical, is by far the best approach.

Dr. Sherwood Burge, an internationally recognized authority on the health effects of indoor air quality from the U.K., in a keynote speech to the World Conference on Indoor Air in Toronto last summer, concluded—and I quote—"that ventilation rates and CO2 levels in themselves do not relate to building sickness and cannot differentiate substantially between sicker and healthier buildings."

The ASHRAE Standard 61-1989 does provide guidance on ventilation rates for a wide variety of applications, and these rates are further qualified by extensive provisions relating to HVAC system design. The proposed legislation conforms neither to the prescribed rates nor to the qualifications to their application.

The requirements for HVAC system operation, maintenance and record keeping contained in section 15 are both utopian and draconian. Enforcement of these provisions by OSHA, as directed by the bill, would require a vast control apparatus to oversee compliance in every building falling within the aegis of this law—an order of magnitude of ten million buildings.

While research continues that may enable in the future the measurement, identification and determination of safe exposure levels of all indoor contaminants, the requirements of sections 16 and 17 are beyond present capabilities.

It is observed that no appropriation to carry out the provisions of these three sections is identified. The cost of their implementation to the Federal and other tiers of Government and to the private sector is so clearly staggering as to render such implementation impossible.

My recommendation to overcome the defects of this bill, and by far the easiest and quickest approach, is to delete sections 15, 16 and 17 from H.R. 1066.

I thank you.

[The prepared statement of Mr. Wheeler follows:]

Testimony to the Subcommittee on Natural Resources, Agriculture Research, and Environment of the Committee on Science, Space, and Technology regarding the Proposed Legislation HR1066, Indoor Air Quality Act of 1991 by Arthur E. Wheeler, PE on May 9, 1991

This testimony is based upon my knowledge as a professional engineer with responsibility for the design of heating, ventilating and air conditioning systems for a wide variety of building types over a period spanning 40 years. I am a graduate of Duke University, a Fellow and recipient of the Distinguished Service Award of the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE). I am a member of the ASHRAE Standard Project Committee that produced Standard 62-1989, Ventilation for Acceptable Indoor Air Quality, and conduct Professional Development Seminars for ASHRAE on Indoor Air Quality throughout the country.

While the Findings introduced in the bill tend toward hyperbole and contain thinly supported statistics, the purposes of the Act are essentially sound and consistent with the continuing well founded efforts by the Environmental Protection Agency and other government agencies toward expanding our knowledge of building air quality through research, through education and through collaboration with manufacturers of building materials and furnishings.

Two changes could make the program itself more effective.

1. Strengthen the authority of EPA within the interagency Committee on Indoor Air Quality to assure efficient, coordinated progress of the program.
2. Adopt more realistic objectives for asbestos and radon control that are consistent with current scientific assessments of risk.

The primary object of my testimony is directed at the **Ventilation Standards for Public or Commercial Buildings**, Sections 15 and 16 and the enforcement provisions of Section 17. These sections are poorly crafted. The proposed ventilation rates of 20cfm of outdoor air per occupant and 60cfm of outdoor air per smoking occupant are arbitrary and unsupported by the new ASHRAE Standard. In a curious paradox it requires new buildings to be tight thereby reducing the true ventilation rate. This tightness requirement virtually mandates that all buildings throughout the country be air conditioned.

These requirements would have substantial impact increasing energy use especially in schools, theaters, restaurants, shopping centers, not to mention office buildings. Also increased would be energy demand for heating and cooling thus taxing electrical generating and distribution capacities. Increased energy use exacerbates atmospheric pollution by increased emission of carbon dioxide and sulfur dioxide from heating and electrical generating plants. Moreover, the construction cost for heating and cooling capacity is substantially increased for some building types, such as schools, inhibiting new construction and rehabilitation of existing facilities.

Wintertime ventilation with excessive amounts of outdoor air with low moisture content can actually reduce the healthful quality of the building environment by reducing relative humidity.

The very premise that increased ventilation by outdoor air will solve indoor air quality problems - which in fact may occur in only 20% of our buildings - is tragically over-simplistic. Outdoor air is useful for diluting contaminants generated within the buildings. It is secondary as a means of control only to source control, which where practicable is by far the best approach. The drastic reduction of formaldehyde in the production of building materials is a significant achievement in source control, whereas ventilation is capable of actually increasing the emission rate of formaldehyde from some materials such as plywood.

Dr. Sherwood Burge, an internationally recognized authority on the health effects of indoor air quality from the UK, in a keynote speech to the World Conference on Indoor Air in Toronto last summer concluded, "...that ventilation rates and CO_2 levels in themselves do not relate to building sickness and cannot differentiate substantially between sicker and healthier buildings."

This is not an isolated opinion, but is supported by the work of many scientists throughout the world.

The ASHRAE Standard 62-1989, cited in HR 1066, does provide guidance on ventilation rates for a wide range of applications. These rates are further qualified by extensive provisions relating to HVAC system design. The proposed legislation conforms neither to the prescribed rates nor the qualifications to their application.

The requirements for HVAC system operation, maintenance and record keeping contained in Section 15 are both utopian and draconian. Enforcement of these provisions by OSHA, as directed by the bill, would require a vast control apparatus to oversee compliance in every building falling within the aegis of this law - on order of magnitude of ten million buildings!

While research continues that may enable in the future the measurement, identification, and determination of safe exposure levels of all indoor air contaminants, the requirements of Sections 16 and 17 are beyond present capabilities. It is observed that no appropriation to carry out the provisions of these three sections is identified. The cost of their implementation to the federal and other tiers of government and to the private sector is so clearly staggering as to render such implementation impossible.

Two approaches to overcoming the defects of these sections are feasible. One is thoughtful rewriting by knowledgeable persons, both in and out of government. The second, and clearly the easier and quicker course, is to **delete these three sections, 15, 16, and 17 from HR 1066**.

My recommendation is for the latter course.

Your wise consideration is needed by the American people.

Mr. **Scheuer**. Do you feel that it is not within our competence, Mr. Wheeler, at the present time, to approach the matter of ventilation standards, emission standards, so as to improve the comfort and the safety of those buildings?

Mr. **Wheeler**. I think that we are deluding ourselves if we think we can accomplish it by just outdoor air. What really has been the province of the building codes in the states and the cities, which do call for ventilation rates, these need to look at the ASHRAE standards and adopt those things in an intelligent and well-informed fashion. This takes time. I don't think that that time has gone into this particular bill.

Mr. **Scheuer**. Dr. Hedge, do you substantially agree with Mr. Wheeler?

Dr. **Hedge**. Yes, I do, because the research evidence shows that it's not really the ventilation rate that's important in looking at symptoms, but it may be the kind of ventilation system, how that system is maintained, whether there are contaminants within the system or immediately outside of the building. All of those factors, if you increase the ventilation rate, can make the situation significantly worse rather than better. So there is no clear evidence as yet that increasing ventilation actually has the benefits it's supposed to have—unless the air is clean air.

Mr. **Scheuer**. Yes.

Dr. Janssen, please proceed for your four minutes.

Dr. **Janssen**. Mr. Chairman, thank you for the opportunity to be here today and speak on behalf of ASHRAE. I am chairman of the committee that wrote ASHRAE Standard 62-1989. Incidentally, the standard has now been endorsed by the American National Standards Institute and is an American national standard also.

ASHRAE Standard 62-89 is the only voluntary consensus standard in the United States that specifies the ventilation buildings must have to achieve acceptable indoor air quality. The latest revision of Standard 62 has been made to define the amount of ventilation for 91 different applications, while minimizing the energy penalty imposed.

We are pleased to see that the Federal Government has taken renewed interest in the indoor environment, but we find the proposed legislation presents an overly simplified approach to building ventilation and it ignores important energy- conserving procedures contained in ASHRAE 61-89.

It is clear that buildings must be ventilated to replace oxygen consumed by the occupants. Additionally, contaminants produced by the occupants, their activities, processes in the space, and volatile materials that may be present must be controlled. Three strategies may be used to do this. Contaminants may be removed at the source, contaminants that may be filtered from the air in some cases, or contaminants may be diluted to acceptable concentrations with less contaminated air.

Source control is advised by advocates for specific contaminants. This is recommended, where possible. Prohibition of the use of certain materials, such as asbestos and lead-based paints, has been effective. Dilution, however, is the only viable means for dealing with contaminants such as carbon dioxide exhaled by the occupants, perspiration odors and air-borne infections from occupants, Standard 62-1989 offers two independent means for compliance. The ventilation rate procedure specifies ventilation based on research and experience that will dilute to acceptable concentrations the contaminants in a given application under normal circumstances. The ventilation rate procedure also describes several energy-saving options. The minimum ventilating rate is 15 cfm per occupant, and this rises to a total of—to a maximum of 60 in smoking lounges. Some applications, such as garages, base the ventilation on floor area, and others such as hotel bedrooms and the room itself. Thus, it is clear that the proposed bill greatly oversimplifies the specification of ventilation for various applications.

The alternate air quality procedure of Standard 62-89 leaves the ventilating rate unspecified but requires that the contaminant concentrations be held within acceptable limits. This is a direct approach to controlling indoor air quality.

Unfortunately, we are agreed on only nine contaminants. Identification of other contaminants of concern and determination of their safe limits is needed for general use of this method. However, the VA Hospital in Cincinnati is an example of successful operation under the air quality procedure.

The Federal Government can play an important role in solving the indoor air quality problem. Accountability for the proper design and operation of building systems is needed. Proper enforcement of building codes reinforces the design issue. The present system for assuring safety of boiler operation is a successful example of how a competent operation can be achieved. Most if not all of the states have code enforcement divisions that examine and license boiler operators. A similar procedure should be investigated for building system operators.

As stated earlier, research is needed to catalog the contaminants present in the indoor environment, and safe concentration limits for each must be established. Evaluation of the total pollutant exposure to individuals and the contribution of indoor sources to this exposure is an area where the Federal Government can make an important contribution.

In conclusion, ASHRAE Standard 62-89 is now an American national standard for achieving acceptable indoor air quality in buildings. The standard defines ventilating rates needed to achieve freedom from odor, irritation, and create a comfortable environment with minimum exposure to health risk. The alternate air quality procedure, Standard 62, provides a means for direct control of the indoor air quality, but knowledge is lacking for widescale use of this procedure.

Finally, training and perhaps licensing of building system operators on the proper operation of building ventilation systems in accordance with ASHRAE Standard 62-1989 is needed. This is probably best carried out at the state level.

[The prepared statement of Dr. Janssen follows:]

WRITTEN STATMENT OF THE

AMERICAN SOCIETY OF HEATING, REFRIGERATING, AND AIR-CONDITIONING ENGINEERS

PRESENTED BY

MR. JOHN JANSSEN, CHAIRMAN
ASHRAE STANDARDS PROJECT COMMITTEE 62-1989

TO

THE SCIENCE, SPACE AND TECHNOLOGY SUBCOMMITTEE
ON NATURAL RESOURCES,
AGRICULTURE RESEARCH AND ENVIRONMENT

THE HONORABLE JAMES H. SCHEUER, CHAIRMAN

May 9, 1991

PART I: ASHRAE and Indoor Air Quality

The American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) is a technical society with a worldwide membership of more than 50,000 persons dedicated to the application and advancement of knowledge related to the heating, ventilation and air-conditioning of buildings, and to the processes of refrigeration.

Thus, one of ASHRAE's primary foci is indoor air quality (IAQ), which may be defined as the nature of air that affects occupant health and comfort. This focus specifically pertains to IAQ as it is affected by the design, installation, operation, and maintenance of heating, ventilating and air-conditioning (HVAC) systems and equipment because:

- A fundamental objective of HVAC systems is to provide comfort and minimize the exposure of building occupants to contaminants in the indoor air.
- Without proper design, installation, operation, and maintenance, HVAC systems may become primary or secondary sources of indoor contaminants.

Indoor air quality may be described in terms of three criteria:

1) Concentrations of oxygen and carbon dioxide must be within acceptable ranges to allow normal functioning of the respiratory system;
2) Concentrations of gases, vapors and particulates must be below levels that can have deleterious effects or that can be perceived as objectionable by the occupants; and
3) Thermal condition of the air must be adequate to provide thermal acceptability for the building occupants

These criteria are specified in ASHRAE Standards 62 and 55.

ASHRAE standards and guidelines address test procedures for evaluating products, product specifications, and system operating performance. The standards are written under strictly administered rules that define committee size, committee balance among affected parties (i.e. manufacturers, users, interest groups, etc.), public review of draft standards, and appeal processes for unresolved differences. ASHRAE standard-writing procedures have been coordinated with (and accepted by) the American National Standards Institute (ANSI). ASHRAE standards are reviewed every five years or less, and are updated to incorporate the newest proven technology.

ASHRAE's first ventilation standard was published in 1973, and most current state and city building codes are based on this standard. The latest edition of ASHRAE Standard 62, published in 1989 and entitled "Ventilation for Acceptable Indoor Air Quality," reflects the current knowledge of contaminants in the indoor air and means for their control. ASHRAE Standrard 62-1989 is a revision of earlier editions published in 1973 and 1981, and it incorporates changes necessitated by the increasing knowledge of the requirements for acceptable indoor air. Action is underway (or completed) by the three major model-building code-writing groups (Southern, BOCA and ICBO), several state and some city building-code groups to adopt Standard 62-1989.

Standard 62: Ventilation for Acceptable Indoor Air Quality

Contaminants in the indoor air may be controlled by one or a combination of three different procedures. A contaminant may be removed at its source, it may be filtered out of the indoor air, or it may be diluted to an acceptable concentration with less contaminated air. Products of combustion from heating systems are removed at the source by capturing and venting up a chimney. Particulate matter, such as tobacco smoke, is sometimes removed with efficient filters.

Dilution, however, is the method most commonly used in residential and commercial buildings. Indeed, dilution is the only practical method known for controlling the contaminants produced by the human body, (i.e. carbon dioxide exhaled, odors from perspiration and other body emissions and sometimes communicable diseases). Studies of the incidence of respiratory infection among U.S. Army recruits housed in new, energy efficient barracks (as compared with those housed in older, poorly sealed buildings) showed a marked increase in the spread of disease. The new barracks were estimated to have infiltration rates (passive ventilation rates) of less than 5 cubic feet per minute (cfm) of outdoor air per occupant compared with 10 to 20 cfm per occupant in the older barracks. Thus, while source control is desirable and practical for some contaminants, ventilation is required to satisfy the needs of human occupants of buildings.

ASHRAE's Standard 62-1989 has also been endorsed by ANSI and is now an American National Standard. The standard is the only recognized authority that specifies the desired performance of building ventilation systems.

Basis of ANSI/ASHRAE Standard 62-1989

It is clear that occupied buildings must be ventilated to replace oxygen consumed by occupants and to dilute the carbon dioxide exhaled. Further requirements are imposed by odors humans produce through perspiration, the need to minimize the spread of respiratory infection, the need to dilute and remove contaminants produced by our indoor activities (e.g., smoking), and the need to dilute and remove other contaminants emanating from building processes and materials.

Of these needs, dilution of carbon dioxide is of most critical concern. It takes more ventilating air to dilute carbon dioxide in indoor environments than to replace oxygen consumed by building occupants, and there is no way to escape the contaminants that humans produce.

The acceptable maximum carbon dioxide (CO2) concentration in room air has been found to be 0.1 percent (1,000 ppm). This limit has been recommended by the World Health Organization, the European Community and Japan. To keep the concentration of CO2 in room air below this level, calculations and measurements show that 15 cfm of outdoor air per occupant is needed under normal physical activity of building occupants. The outdoor air must meet National Ambient Air Quality standards, or to be treated to do so.

Laboratory research at Yale University and at the Technical University of Denmark has shown that 15 cfm of outdoor air will dilute occupant odors to a level acceptable to at least 80 percent of the people entering an occupied space from outdoors. Research on tobacco-smoke odor at Yale's John B. Pierce Laboratory has also shown that with today's reduced smoking rate, 15 cfm of outdoor air will dilute environmental tobacco smoke to a level acceptable to 70 percent of the people entering an occupied space (where about 27 percent of the occupants smoke at a rate of 1.25 cigarettes per hour). This equates to one pack per 16-hour day. Other calculations on the tobacco-smoke perception of non-smoking occupants in a room for 15 minutes with smokers show that non-smoking occupants will register 90-percent acceptance under the assumed conditions. Thus Standard 62-1989 appears to be able to control tobacco smoke odor under minimum smoking conditions.

There are also many indoor contaminants other than CO2, body odor and tobacco smoke with which to be concerned. Allowance is made for these in Standard 62-1989 by increasing the specified amount of outdoor air. The recommended ventilating rate for office spaces is 20 cfm per occupant. Past experience shows that this will control emissions from carpeting, furniture, office machines, etc. Blueprint machines and large photocopying equipment require their own direct-exhaust systems. Bars and cocktail lounges require 30 cfm per occupant and smoking lounges require 60 cfm per occupant, with direct exhaust (i.e., no recirculation of the air) from the room.

Section 5 of Standard 62-1989 gives guidance and warnings for contaminant sources that may arise or be affected by the system itself. Among these is the problem of biological contaminants (e.g., Legionnaires Disease) that may grow in the dirt that collects in ducts under conditions of high humidity. Thus, moisture control is an important part of achieving an acceptable indoor environment.

ASHRAE Standard 62-1989 provides for two independent means of compliance. The *Ventilating Rate Procedure*—the one most often used—specifies the amount and quality of the air to be used to ventilate 88 different indoor environments. The recommended ventilating rates vary from 15 cfm per occupant in clean environments such as schools, auditoriums, etc., to 60 cfm per occupant in smoking lounges. In some cases, when the main source of contaminants comes from the materials or processes going on in an indoor space, the recommended ventilating rate is based on the flow per unit of floor area. Residential ventilation is based on the volumetric change of air in the structure, i.e., air changes per hour.

The alternate procedure in Standard 62-1989 is the *Air Quality Procedure*. This provides for direct control of contaminant levels whereas the Ventilating Rate Procedure gives indirect control. The Air Quality Procedure is only now beginning to be used. This procedure leaves the amount of ventilating air unspecified, but indicates contaminant concentrations be held within acceptable limits. Effective use of this procedure requires the design engineer to resolve three questions:

1. What are the acceptable concentration limits for the contaminants, most of which are in the gas or vapor phase?

   The National Ambient Air Quality Standard lists five contaminants and Section 6.2 of ASHRAE Standard 62-1989 lists four more. Not included in the nine contaminants listed in the body of the Standard are such common contaminants as formaldehyde, other volatile organic compounds, tobacco smoke, and a variety of other compounds listed in Appendix C of Standard 62-1989. What are acceptable limits for these materials?

2. What equipment is available for removing gaseous contaminants?

3. If such filtration systems are used, what assurance can be provided that the necessary maintenance will be carried out for the lifetime of the building system? Gas-phase filters generally require the use of chemical reagents that must be replaced periodically.

Use of the Air Quality Procedure assures direct control of the indoor environment with minimum energy cost. The answers to these three questions can accelerate the implementation of the Air Quality Procedure.

A few projects are operating which were designed by the Air Quality Procedure. The Westin Peachtree Plaza Hotel in Atlanta and the Veterans Administration Medical Center in Cincinnati are two examples. They provide significant energy savings. Their performance should be carefully monitored to assure success of this technology. In particular, the method of assigning and ensuring responsibility for proper maintainence of the system is important. In order to ensure indoor air quality, the design, construction and operation of ventilating systems must be performed in a responsible and accountable manner.

Some comments related to residential situations are included in Attachment A.

Economic Costs of Increased Ventilation

In a peer-reviewed study published in *ASHRAE Transactions* in 1988, J.H. Eto reviewed simulations on the energy impacts of increasing ventilation rates from five cfm per person to 20 cfm per person in 13 large office buildings in the United States and Canada.

His results suggest that higher minimum-ventilation rates, while significantly affecting equipment-sizing decisions, have a relatively small effect on annual energy use for the buildings and climates examined. Increases in annual energy operating costs were small (less than 5 percent) because electricity is the dominant component of energy cost and a significant portion of electricity is used primarily for non-space-conditioning purposes. In particular, the simulations did not support a one-to-one relationship between percentage increases in minimum outside air ventilation and increases on annual building energy and construction costs.

Related ASHRAE Standards and Guidelines

Although Standard 62 is the principal standard, ASHRAE has several standards related to indoor air quality. Standard 55, "Thermal Environmental Conditions for Human Occupancy," specifies the combination of factors necessary for thermal comfort within the built environment. Important environmental parameters are temperature, thermal radiation, humidity, and air movement. Important occupant parameters are type of clothing and level of activity. Standard 62 requires that ventilating systems be designed and installed so that they do not cause conditions which conflict with Standard 55.

One related standard ASHRAE is developing is Standard 129P, "Standard Method of Testing Ventilation Effectiveness," which is intended to provide a repeatable and accurate method of evaluating an air-distribution system's effectiveness in providing required levels of ventilation air to building occupants. Another standard under development would establish a method of measuring ventilation rates in detached buildings (such as single-family dwellings) where air infiltration (through cracks, and around windows and doors, for example) is a contributing factor.

Indirectly, ASHRAE's energy conservation standards 90 (for new building design) and the 100 series (for existing buildings) may affect indoor air quality through provisions that require tightened building envelopes, which may increase the concentration of indoor air contaminants by reducing infiltration. Standard 52, "Method of testing Air-Cleaning Devices Used in General Ventilation for Removing Particulate Matter," addresses devices that may be used to improve air quality through air filtration.

PART II: The Federal Response

Because of the diversity and heterogeneity of indoor spaces, and because of the shared responsibility for indoor air quality and the relatively recent increase in awareness of indoor air quality problems, knowledge of the distribution and concentration of contaminants is incomplete and not well organized. Knowledge of adverse health effects on the occupants is even less adequate. Often, dissatisfaction with indoor air quality is due to acute discomfort and irritation rather than observed illness. Such association of indoor air contaminants with illness is unlikely to be observed without very carefully designed studies. In addition, few such studies have been carried out with simultaneous, adequate characterization of exposure, illness and other factors.

ASHRAE recognizes the need for government involvement in indoor air quality issues, particularly involvement that spurs research (publicly, privately and jointly funded). No single private-sector group (professional or technical society, manufacturing or trade association, or branch of industry) has the comprehensive interest, resources and competence in indoor air technology to ensure that a well-funded, systematic research and development program is conducted.

The federal government can play an important role in supporting basic research on indoor air health issues, particularly on the dangers of indoor air pollution to populations identified at risk. Evaluation of the total pollutant exposure to individuals and the contributions of indoor sources to this exposure is an area where the federal government can make a contribution. Of particular importance are radon, asbestos fibers, unvented combustion appliances, formaldehyde, tobacco smoke, and volatile organic compounds.

Technology Transfer

ASHRAE considers the transfer of technology a fundamental obligation of a technical society, and is dedicated to unrestricted dissemination of knowledge and information related to heating, air conditioning, ventilation and refrigeration.

The oil embargo of 1973 put new emphasis on the use of energy for controlling the indoor environment while achieving acceptable indoor air quality. ASHRAE is dedicated to achieving both goals, and each year funds over $1 million of research in pursuit of those goals among others. Funds are raised from the private sector to carry out research projects. Research results are preserved in the Society's *Transactions* of technical papers, its monthly *Journal* articles, and its four-volume *Handbook*. One volume of the *Handbook* is reviewed, revised and republished each year to capture newly-published technology. This technological base is used as instructional materials in university courses, as guidance by practicing engineers and as a resource in the consensus standards published by ASHRAE.

The responsibilities and activities within the federal government are diffuse. It is very important that the federal government continue to coordinate its indoor air quality efforts on this issue. As new knowledge and data become available from federal government research and studies, this technology should be distributed to the ultimate users through existing private-sector channels, which include technical handbooks and periodicals, technical conferences, the trade press, and so on. Technical experts employed by the federal government should be encouraged to participate in private-sector conferences, meetings, technical committees, and standards-writing activities.

A Comprehensive Standard

ASHRAE Standard 62-1989 specifies the amount of ventilation to be used in nearly 90 different building applications. Provision is made for interrupting, or reducing, ventilation when spaces are unoccupied and for averaging the fraction of outdoor ventilating air in the total supply when a common air handler supplies several spaces with differing ventilation requirements. Guidance is also provided for reducing ventilation through the use of air-cleaning systems. These options provide a safe means of energy conservation.

Specifying a few ventilating rates (as in Section 15 of H.R. 1066) without regard to the many independent and interdependent situations that occur in the nation's public and commercial buildings is a vast oversimplification of a complex problem, however. Such a strategy ignores energy-conserving options that may be used and it may not provide adequate ventilation under other conditions. When this is done, there is no guarantee that satisfactory indoor air quality will be achieved. In contrast, study of "sick-building" episodes show that air-quality problems are rarely encountered when a comprehensive approach is followed as recommended in ASHRAE Standard 62-1989.

In the development or updating of an ASHRAE standard, the latest applicable technological information is thoroughly reviewed and evaluated by recognized experts in the field (including scientists, engineers and practitioners with years of "hands-on" experience). ASHRAE recommends that the provisions of its ventilation standard be taken as a whole to be effective, rather than selecting individual pieces (such as a minimum rate of 20 cfm per person). The quality of the building environment is dependent on many interrelated factors. When Standard 62-1989 is applied in a piece-meal manner rather than as a comprehensive whole, the quality of the indoor air is not necessarily assured and energy may be wasted.

State and Local Codes

Control of the design and construction of building ventilating systems now resides in the state and local building codes. Administration of building codes should remain at the state and local evels. Ventilating system codes should continue to be a part of the overall mechanical code for buildings. Creating a separate federal building code would necessitate costly duplication of effort. The federal government should look to the local code organizations for the implementation of standards related to indoor air quality.

ASHRAE Standard 62 forms the basis for the vast majority of ventilation requirements in building-construction regulations adopted and enforced throughout the United States. Virtually all state and local regulations find their roots in ASHRAE Standard 62. Through the use of model building and mechanical codes, and by direct reference to ASHRAE Standard 62, about 25 statewide codes and the vast majority of local codes (in states without a statewide code) mandate minimum ventilation rates in new-building design.

Although the current edition of ASHRAE Standard 62 is being adopted in three model building codes, the process of transferring new technological requirements from updated standards is slow. Most existing state and local building codes, for example, still use model codes based on the 1973 edition of ASHRAE's ventilation standard. State and local code officials should be encouraged to adopt and enforce the latest version of model codes built on private-sector indoor air quality standards. The development of educational materials and perhaps special seminars for local code officials may assure more complete compliance with codes and standards.

Implementation and Enforcement of Standards

Virtually all new building construction and renovation are covered by codes which include ventilation criteria and duct-construction requirements. Enforcement focuses at the design stage. System designs which show the amount and distribution of ventilating air are approved by state and local building officials. Building inspectors examine the construction site for compliance with approved plans.

However, after the building is commissioned, there is no assurance that the system will continue to function as designed for it normal lifetime. Most indoor air quality problems emerge because building operators may do one or all of the following:

1) readjust controls modifying the air-distribution system,
2) close or readjust the outdoor air-inlet dampers in a misguided effort to conserve energy, or
3) fail to service air-cleaning devices periodically.

Indoor air quality problems also frequently occur when building-use patterns are changed without implementing appropriate changes to the designs of ventilations systems. Even minor changes can create problems, such as dedicating one room for heavy photocopying equipment without increasing the ventilation to make up for higher chemical-emission rates. Other changes can be more dramatic, such as converting a residential building to office-space use (one notable example involves the headquarters building of a federal agency here in Washington, D.C.). At other times, patch-work modifications to the original ventilation-system design can serve to degrade the indoor air quality of a building.

The best model for enforcement of a building code is the American Society of Mechanical Engineers' (ASME) Boiler and Pressure Vessel Code. When steam became popular for both the heating of buildings and the generation of mechanical power after the Civil War, steam boilers blew up with unacceptable frequency, with terrible loss of life and property. A group of mechanical engineers formed ASME in 1885 partly to reduce the hazards from steam-boiler failure. The ultimate result was the ASME Power Test Codes and Pressure Vessel Codes. These codes were accepted by manufacturers, insurance companies, and by state and local authorities. Today, the ASME stamp on a boiler or pressure vessel is an accepted safety endorsement throughout the world. Many foreign countries depend on it. In the U.S., states have created boiler inspection departments and officials to enforce these codes. The boilers used to heat buildings usually require licensed operators and in larger facilities, these licensed operators are responsible for maintaining all mechanical systems (air handling and ventilation systems).

The question which should be studied is the effectiveness of requiring education (and perhaps certification) of building operators related to air-distribution systems. If a building is shown to be able to achieve design performance at the time of commissioning and is then operated by a trained operator, the problems associated with a "sick building" are less likely to appear.

Conclusions

ANSI/ASHRAE Standard 62-1989 is an authoritative guide for achieving acceptable indoor air quality. The standard defines ventilation rates needed to achieve freedom from odor, irritation and create a comfortable indoor environment. ASHRAE Standard 62-1989 is now being adopted by three model codes used by the states and cities.

Accountability for the proper operation and maintenance of building ventilating systems is necessary and must be achieved through the training and perhaps licensing of system operators similar to the manner in which accountability for boiler design, construction and operation is achieved.

The U.S. Office of Management and Budget (OMB) Circular A-1119 directs federal agencies to utilize voluntary consensus standards where applicable and to particpate in private-sector standards-writing activity through involvement of federally-employed technical experts. As the only nationwide consensus-based technical standard on ventilation and acceptable indoor air quality, ASHRAE recommends Standard 62-1989 as the standard of choice for adoption by reference for state and local building codes and regulations.

ATTACHMENT A

The Special Case of Residential Ventilation

by John E. Janssen, P.E., ***Chair***
ASHRAE Standards Project Committee 62-1989.

Residential ventilation presents a special problem to the indoor air equation. Infiltration through cracks and windows has been relied upon to ventilate homes. Now, however, with technology available today, a residence may be constructed so tight that it may become dangerous.

The natural reaction to this is to require mechanical ventilating systems in all newly constructed homes. This idea is widely advocated by the home-ventilating industry. Unfortunately there are at present no standards, codes or means of assurance testing to ensure reliability of the equipment. If a house is to be made exceptionally tight and then ventilated with a mechanical system, the equipment must be reliable, it must be able to operate for long periods of time (years) without maintenance, and safety controls must be developed to provide a warning in the event of a system failure.

The problem is further complicated by other equipment that may or may not be present in a home. Exhaust systems in kitchens and bathrooms, clothes dryers, fireplaces and furnaces all compete for the ventilating air supplied to a house. Operating a fireplace in a tight house can make the furnace "spill" combustion products from its chimney. The state of Minnesota requires a duct of the same size as the furnace stack to supply outdoor air directly to the furnace. This assures a supply of combustion air and prevents back drafting of the furnace stack. In cold weather, however, the cold air can interfere with proper operation of the furnace.

The conclusion is that at the present time there is no good answer to the problem of residential ventilation. Extreme efforts to make a house tight should not be undertaken, since deaths have occurred through such measures. Standard 62-1989 recommends an infiltration rate of 0.35 air changes per hour and installed exhaust fans for intermittent use in kitchens and bathrooms. If this infiltration rate is achieved under nominal operating conditions, i.e., a five mile-per-hour wind or an indoor-outdoor air temperature differential of 20°F, there should be little chance of problems. Occupants should be educated to use kitchen and bathroom exhaust fans or to open their windows when unusual contaminant sources are present. There may be cooking, bathing and unusual numbers of people present. Fireplaces should have a source of outside air for proper combustion and operation of the chimney.

Residential ventilation presents different problems as have already been discussed. Mechanical ventilating systems for residential use probably should receive further attention. There is a question to be resolved as to whether residential mechanical ventilating systems that employ heat recovery actually conserve energy on a national scale. The laws required use electrical energy which is no more than 30% efficient by the time it is delivered to the fan motor. Thus, each watt of fan motor power requires 3 watt equivalent of fuel at the power plant. The heat recovery ventilator does conserve gas or oil at the furnace and the power plants are usually fueled by coal or nuclear energy. Thus, there may be some advantage in substituting other fuels for natural gas.

The most practical solution to residential problems may be to learn how to construct homes so they "breathe" at the desired rate. There is an extensive body of knowledge on infiltration in homes. Research appears to show that a home with weather stripping on the doors and windows, plastic vapor barrier in the outer walls, but no vapor barrier on the ceilings or partition walls should achieve an infiltration rate of about 0.35 air changes per hour as specified in Standard 62-1989. Provisions should be made to supply outdoor air for combustion directly to fireplaces. This approach needs further study, but it appears to be the most trouble free solution.

If mechanical ventilation is selected for residential use, automatic controls needed to use fan-powered ventilation only when natural ventilation is insufficient. An experiment for Bonneville Power Administration involved placing a sensor on the roof of the house to measure wind speed and indoor-outdoor temperatures difference. The ventilating fan was turned on only when the wind velocity was less than 5 mph or the indoor-outdoor temperature difference was less than 20°F. While the sensor employed for this test needs further development, the concept was quite successful. This system conserves fan power when natural forces provide sufficient ventilation.

Mr. **Scheuer**. Well, there's been some profoundly disquieting testimony give today by you gentlemen, particularly Mr. Hedge, Mr. Wheeler, Mr. Wolfert to an extent. I would hope that we could work informally with you—I respect your professionalism very much—and see if we can't get some of the kinks out of this.

A couple of questions for the whole panel, for anybody who wants to answer. Should the existing buildings be held to the same standard for ventilation rates as new buildings? Is that practicable and doable without inordinate expense?

Dr. **Janssen**. Yes, I think that, where possible, this should be done. I think most buildings have the capability of increasing their ventilation. The older buildings, ones built before 1970, probably are already meeting the current requirements.

Mr. **Wheeler**. I have a different answer. If you think of office buildings, I agree with John. On the other hand, when you look at schools, it may be a whole different ball game. The entire system of ventilation and air conditioning, along with changes in refrigeration and heating capacity, will be necessary in many, many cases in order to meet the ASHRAE standards, let along the ones that have been advocated here in 1066.

Mr. **Scheuer**. You heard my comments, or my questions, briefly about that school out in Virginia, that we've all read about and seen reported on television. Do you have any insight as to how those local school authorities should be managing that problem?

Dr. **Janssen**. Well, from what I've seen, the problem really has not yet been defined. There are three levels of investigation normally when you attack one of these sick building problems. The first is just an inspection. Somebody who is trained in the art goes in and inspects the obvious things, looks for dirt in the system, standing water under cooling coils, are the outside air dampers open or shut and things of this sort.

The next level, if this doesn't turn up any obvious solutions to causes of the problem, the next level is to go in with a minimum amount of instrumentation and make some specific measurements.

Mr. **Scheuer**. Of what?

Dr. **Janssen**. Of things like the carbon dioxide level, the air movement in the rooms, the amount of outdoor air coming into the building, things of this sort.

If that still doesn't answer the problem, then you have to go in with a full-scale, scientific investigation and measurement of the conditions there. This includes also a measurement of biological species and a lot of other things of this sort. But, in general, that usually identifies where the problems are.

Mr. **Scheuer**. Yes, Mr. Wheeler, and then Dr. Hedge.

Mr. **Wheeler**. I might say there's been a number of protocols similar to what John has described, one of which has been developed by NIOSH, and it's quite good. I think that if somebody is in a problem, they could resort to those protocols and I think come up with an orderly solution of how to deal with the problem.

Mr. **Scheuer**. Yes. You heard the representative from NIOSH who said, of course, they had no jurisdiction. But do you think it would be helpful if those protocols were brought to the attention of school authorities and say, look, in the absence of something better, maybe you had better be thinking about proceeding along these lines? It seems to me, if we could get out something that was reasonable and cost-effective and not wasteful and not silly, the schools—it might get the attention of the school authorities, and also it would give other local leaders, the PTAs and teachers themselves and others, a handle, to say look, this is what NIOSH is doing and the Feds tell us we ought to think about proceeding along these lines, let's go for it.

Mr. WHEELER. That's a very effective approach that EPA can undertake and should. I think it continues with what they have already done in terms of public and institutional education.

Mr. SCHEUER. That's not EPA, that's NIOSH. But you think EPA should be doing some jawboning to the local authorities?

Mr. WHEELER. EPA can take the material that NIOSH has developed and then get it into the hands of the people that need it.

Mr. SCHEUER. Right. Yes, Dr. Hedge.

Dr. HEDGE. I regret I don't know the details of this case, but it's also important to look at who's actually being affected, to see where they're being affected, when, what the precipitating events might be, what the pattern of complaints over time might be, to get a clue as to whether the cause has actually anything to do with the air quality or not.

One thing that we see in many buildings—in fact, I've worked in a number of buildings that have been evacuated—is that when you look at the pattern and distribution of complaints, and how things have progressed over time, then it's quite clear that it was not an air quality problem necessarily that precipitated the complaints amongst people.

Mr. SCHEUER. What kind of a different problem could it be?

Dr. HEDGE. What kind of different—It could be—there's a problem called mass psychogenic illness. It could be a psychogenic-generated problem, where people begin to attribute symptoms like headaches or eye complaints to the environment, whereas they may have been experiencing those symptoms over a period of time and it may have nothing at all to do with the environment. It may be other factors.

For example, we find—

Mr. SCHEUER. Where would it come from, now? Where would these symptoms—How would these symptoms have been produced if not from the environment in the building?

Dr. HEDGE. The symptoms are produced from all environmental, both external and internal factors that impact on you as an individual. That includes things like stressful events that can actually cause you to develop certain symptoms that you may or may not attribute to the environment. Actually determining whether it's one specific thing such as an absolute that's causing a symptom or not proves to be terribly difficult. In fact, the large epidemiological studies that have been done of sick building syndrome, which have measured a wide range of pollutants, typically have found no relationship between any of the measured pollutants and the symptoms people are reporting. But they have found, at least for commercial buildings, they have found substantial relationships with things like occupational stress levels and certain personal characteristics. So these occupational psychosocial factors certainly play a mediating role in changing maybe how we react to the environment.

But that's the area where we really know very little. That's the area that's been grossly under researched, the human side of the equation.

Mr. SCHEUER. Now, let's just take two buildings that we can refer to as sick buildings, because of the significant percentage of people who have felt all of these phenomenon—dizziness, nausea, watery eyes, burning nose, whatever—that EPA building in southwest Washington would qualify as one, and this school that we're talking about in Springfield, VA would be another, where 40 percent of the people were affected.

Is it plausible to feel that, in a building like this, where 30 or 40 or 50 percent of the people suffer significant discomfort, if not illness, requiring them to go home—the history that we heard of that EPA building was that some of those people couldn't any longer work in that building, that they had to retire, that they were permanently incapacitated—are you suggesting that those patterns could be significantly induced by other factors than the air quality, that they could be produced by stress, by various other psychosocial phenomena, and that they're substantially unrelated to air quality?

Dr. HEDGE. Yes, they may well be substantially unrelated to air quality. They may relate to other factors.

If you take the phenomenon of multiple chemical sensitivity, the latest medical research on that suggests that maybe two-thirds of people who report those problems actually are suffering from depressive illnesses of various sorts. There is no clear evidence from a medical standpoint that exposure to contaminants is actually what creates symptoms in those people.

Now, I'm not suggesting that the symptoms people report are imaginary. What I'm saying is that when we report a symptom, we have to decide what may or may not be causing that. And the relationship between the physical environment and symptom reports, for most of the problems that I've researched, it's not a dose response relationship. We find, if anything, that things are the reverse.

Let me give you an example. There's a large Swedish study that's been done looking at industrial workers who are known to be exposed to pollutants, and looking at office workers who are known not to be exposed to pollutants, showing that the kind of symptoms we're talking about are significantly more prevalent amongst the office workers than amongst the exposed workers. In other words, exposure to pollutants doesn't determine the symptoms.

The same thing—Sorry?

Mr. SCHEUER. What does determine the symptoms?

Dr. HEDGE. That's a very good question. I don't know the answer to it. Unfortunately, there isn't sufficient research as yet to really determine that. But what we do know, consistently, from studies that have been done in Scandinavia, in Holland, in Germany, in the U.K. and in Canada, and now in this country, what we do know is that factors such as occupational stress, computer use, the gender of the person, level of job satisfaction, all of these factors show a high association with many of the symptoms that are attributed to the air quality. What we don't understand is whether they are affecting a person's physiological state so that some people who are under stress are sensitized to factors in the environment or whether, in fact, it's other processes that are causing symptoms to be reported.

But it is quite erroneous to assume that just because you improve the air quality in a building you will necessarily resolve the problems.

If I can just give you an analogy—

Mr. SCHEUER. Well, let me just ask you about Mr. Wolfert's testimony. He testified that in one building of 500,000 square feet, it would cost them a half-a-million dollars a year extra expense to live up to the ASHRAE standards. Was that what you testified to?

Mr. WOLFERT. This was to satisfy the statement in the proposed legislation, 60 cfm.

Mr. SCHEUER. Okay, yes.

And that would add up to about a five percent expense, increase in their expenses, which is considerably, particularly since that goes mostly to the bottom line, Mr. Wolfert. That would have a demonstrable effect on the profitability of that building, unless, of course, that five percent increase were passed on as a rent increase of roughly five percent.

Now, are you suggesting that we don't really know enough to ask Mr. Wolfert to spend a half-a-million dollars more on air conditioning and whatever other remedial efforts, since we don't really know whether folks who suffer demonstrable sneezing, this, that and the other thing, demonstrable health outcomes—demonstrable negative health outcomes—we don't know whether there's any cause and effect between those folks and their symptoms and the air quality of that building? Are we really doing something that's silly? Are we imposing a significant expense on Mr. Wolfert's building that has no apparent justification?

Dr. HEDGE. I don't believe it's silly. I believe there are two issues. One issues is looking at what may cause the health problems people experience in buildings, and the second issue is what do you have to do to the ventilation in a building to achieve a certain level of air quality. Where there's a very poor link in the research is between the air quality levels and between the symptoms people report.

Mr. SCHEUER. Yes, now—Excuse me. Let me just interrupt.

We know there are some things that you can identify where there is a cause and effect relationship—

Dr. HEDGE. Right.

Mr. SCHEUER. —between the presence of those elements in the air and the way people feel. And one would be, I suppose, environmental tobacco smoke, and another would be radon. Would you accept that those two, the presence of those two in significant levels of intensity, demonstrably affects health?

Dr. HEDGE. Let me just place a caveat on that—

Mr. SCHEUER. Okay.

Dr. HEDGE. —and say that, for example, we cannot detect radon. As human beings, we can't sense the presence or absence of radon, or the levels of radon. The health effects of radon are—

Mr. SCHEUER. But we can measure them.

Dr. HEDGE. We can measure it. The health effects seem to be long-term effects on the pulmonary system. Radon, as far as I know, is not associated with eye, nose, throat irritation, skin complaints, or the kinds of complaints that we commonly see in buildings. Therefore, measuring radon in buildings tells us nothing about those health symptoms.

Mr. SCHEUER. About the health symptoms that produce great discomfort.

Dr. HEDGE. That produce—

Mr. SCHEUER. Which tells you you may be getting cancer over a long period of time, but it doesn't make you sneeze or burn, it doesn't make your eyes burn or make you sneeze.

Dr. HEDGE. That's right. Yes.

If you remember when I started my testimony by actually saying we need to differentiate between different types of health symptoms, those that are life-threatening and those that are nonlife-threatening symptoms of discomfort and irritation. Now, if there's a clear, life-threatening relationship, as there may well be with radon, then it makes sense to measure that pollutant and to control that. But if you are basing recommendations on ventilation rate on complaints of what's termed sick building syndrome, then you may be doing the wrong thing is all I'm saying, because the situation is far more complex than a dose response relationship.

Mr. SCHEUER. Well, it seems incredibly complex. You know, Members of Congress like to have experts like you come here and give us neat, simple, easily comprehensible answers to our problems. You have failed that test utterly.

[Laughter.]

Frankly, I wish that my colleague, Congressman Don Ritter of Pennsylvania, were here today for this particular panel, because the vast uncertainty that you have expressed, as to whether we really know what we're doing and whether we really can require people to spend dollars at significant expense on air conditioning and heating a building differently, in an approved fashion, there's very little cause and effect relationship that we can document now between air quality and all these demonstrable illnesses or discomforts. I think he would have felt that that justified his considerable degree of cynicism, as to whether we know enough to lay expensive responsibilities on building owners to make expensive changes. He's very skeptical and certainly this panel would have justified his skepticism. He would have considered this panel a rich "mother lode" that he had in mind.

I hope you will bring the testimony, the transcript to his attention. He will have great fun pricking my balloon of confidence that we do have the brains and the talent to ameliorate conditions in a building where a lot of people get sick. You're saying it ain't all that easy.

Dr. HEDGE. I am.

Don't misunderstand, also, what I'm saying. If you have a building in which people are—I was going to use the term "genuinely"—have a demonstrable illness, that is, for example, Legionnaire's disease, you know that's caused by an organism Legionella premophilia. You can look for that organism and you can control it and eliminate it—

Mr. **Scheuer**. That's an easy one.

Dr. **Hedge**. That's an easy—

Mr. **Scheuer**. How about the kids and the teachers at that school, or the people who were working in that EPA building, some of whom were really disabled by whatever was going on in that building. You're telling us we really don't know enough to raise heating and air conditioning standards, that the cause and effect relationship may be very dim, that it may exist very dimly, if at all, and that we have to look to each individual's stress and each individual's psychosomatic condition, and that there is no generality of cause and effect?

Ritter would love that, but it bothers me.

Dr. **Hedge**. I think the way to think about the problem is in the same way that we think about other significant health problems, such as cancer or heart disease. That is, we need to construe it as the outcome of multiple risk factors.

For example, with coronary heart disease, we know that there are certain risk factors we can identify, such as cholesterol, such as obesity, smoking, lack of exercise, but we also know that stress is an important component. The same with cancer and the same with these kinds of problems in buildings, we can identify certain risk factors. We know that, in general, more problems are reported in air-conditioned buildings than in naturally ventilated buildings. We know that, in general, women experience more problems than men, that in general, people who use computers experience more problems than those who don't. In general, people who are dissatisfied with their job report more problems than those who don't. And there may well be—

Mr. **Scheuer**. What was that last one? People who what?

Dr. **Hedge**. Are dissatisfied with their job report more problems than most.

We also know from the U.K. study that people who work in government buildings report more problems than those who work in private organizations, even when they're both working within the same kind of building.

And so it's quite clear that there are a number of factors that influence how you report your health status. What we don't understand is how all those factors interact. We don't know whether they act to change the sensitivity of individuals to contaminants that may be present in the environment; we don't know whether there may be contaminants in the environment that we haven't yet identified; or we don't know whether these factors, such as stress and computer use, may actually be causing some of the symptoms that people are reporting.

If you look at the literature in the late Seventies, then people were attributing burning eyes, sore throats and everything to computer use and not to air quality whatsoever. So what we have seen in a change in the attribution here. But we don't have enough research that has clarified what the underlying biological processes might be.

Mr. **Scheuer**. Well, do you think that should be a major thrust of this committee, doing massively more research to answer the very questions that you have raised?

Dr. Hedge. I think a major thrust should be to plead for a change in the orientation of indoor air quality research to include people and the reactions of people in the studies that are done, and not to just look at the physical side of the problem, which is the building and the engineering technology and the physics and the chemistry of the pollutants. We need to understand more on the health side. And when you look to that, you'll find that there is tremendous ignorance at that level. There are a handful of us that are trying to do work worldwide in that field.

Mr. Scheuer. How would you organize such a global research effort?

Dr. Hedge. I don't believe it has to be global. I think that you can actually get a long way by doing much better controlled intervention studies.

For example, if we really wanted to determine what's the effect of ventilation rate over a long period of time, then we could do some very sensible intervention studies. We don't—Let me give you some more data.

We don't know, when people report symptoms in buildings, we don't know very much about the time pattern of those symptoms or the spacial pattern of those symptoms. We don't know whether symptoms vary by season. We don't know whether there's any relationship with how the HVAC system is working and what people are telling us.

In my testimony I mentioned four studies I managed to find. The best controlled of those studies showed that as the ventilation rate was increased, so the symptom reports were increased, but there may be other factors confounding in that study. We really haven't got the high quality scientific research on which to base sweeping legislation.

Mr. Reckinger. May I address something, Mr. Chairman.

Mr. Scheuer. You know—In other words, we don't even know enough to know what we ought to know more of; is that what you're saying, that we couldn't, with our present state of knowledge, we couldn't design a substantially increased research program to investigate all of these anomalies that you're presenting to us?

Dr. Hedge. I think you could design such a program, but I believe that you need to ensure that that program is truly a cross-disciplinary program that actually brings in expertise from outside just the traditional engineering and indoor air quality arena, to bring in medical specialists and behavioral specialists who have information to contribute on what may precipitate health problems amongst employees in buildings.

Mr. Scheuer. Did you want to add something, Mr. Reckinger?

Mr. Reckinger. I appreciate it.

Somehow or another, the whole gist of this is starting to go too much towards section 15 bashing and looking more at theoretical things. I just wanted to add that, in my 30-some years of experience in the design and application and installation and maintenance and service of HVAC systems, many, many systems that are out there—as a matter of fact, the preponderance of systems that are out there—are poorly, poorly serviced and neglected. And as a result, they are causing problems.

I'm not saying that HVAC systems or increased ventilation rates are the thing to correct all problems, and I don't think anyone that has testified here today has implied that. We certainly should see some minimum standards set. I feel that adopting the ASHRAE standards is a step in the correct direction. That is a process that ASHRAE and other professional organizations go through to update and modify those standards, to incorporate the latest advances in technology and information that may be available through future studies.

I could sit here for hours and give literally hundreds of examples of things that were done to systems that were causing problems in buildings: boarding over of fresh air intakes; putting visquine over fresh air intakes. Because a motor was malfunctioning, too much cold air was coming in, so they cut it all off. There's just nightmares like that all over the place. That is not giving a healthy environment to people in buildings, especially those that were built very tight and needed that outside ventilation brought in mechanically into the building.

I think that to try to do away with section 15, or say that ventilation isn't a part of this, would be unfair. I just want to make the case that we should adopt at least the standard as in ASHRAE. I believe the fixed 20 and 60 cfm is too rigid and we have to take into account other factors as well, and be sure that we don't hamper ourselves from adjusting as technology and so forth improves.

Mr. **Scheuer**. Thank you very much, Mr. Reckinger.

You support, unequivocally, the ASHRAE standards and you think they should be adopted?

Mr. **Reckinger**. I think the ASHRAE standard should be adopted as at least a minimum standard at this point.

Mr. **Scheuer**. Okay. I would like to go across the panel and see if we can get some consensus on that as a Federal standard. Should they be adopted as a Federal minimum standard? Mr. Wolfert.

Mr. **Wolfert**. I think they should be adhered to, but it, in my experience, would be better served adopted by the existing code organizations and enforced by those code organizations so that we don't have to create another agency to do all this.

Mr. **Scheuer**. How many code organizations are there around the country?

Mr. **Wolfert**. Three major ones that I'm familiar with, and there are several other regional ones.

Mr. **Scheuer**. And they're private?

Mr. **Wolfert**. Pardon me?

Mr. **Scheuer**. They're private organizations? Are they Government agencies or are they private?

Dr. **Janssen**. They're private organizations.

Mr. **Wolfert**. Private organizations, yes.

Mr. **Scheuer**. Is anybody stopping them from adopting the ASHRAE standards?

Mr. **Wolfert**. As a matter of fact, many of them are in the process right now.

Mr. **Scheuer**. Several of those three?

Mr. **Wolfert**. Yes, sir.

Dr. **Janssen**. All three of them are adopting them now, the new standard.

Mr. **Scheuer**. I see. All right.

Dr. **Janssen**. And these are model codes that are used by the states and cities in various parts of the country. The states codes, several of them, a few, have already been changed, and others are in the process of updating the state building codes.

Mr. **Scheuer**. So you think it's a good code, and I take it there's—Do you feel it should not be a Federal requirement at the present time?

Dr. **Janssen**. Yes, I believe that probably this should be left at the state level.

I would also like to disagree a little bit with some of the things that's been said here about specific building problems. There are a number of engineering organizations in the country who are doing sick building analysis work. I don't know of any case where the cause of the problems in a building haven't been identified. The amount of testing that's required varies considerably, but I think the protocols that have been developed, the technology is there, that you can find out what's wrong.

Now, I also have to agree, though, that many times you have to be able to separate the psychological factors, the peripheral factors, from the actual physical factors that people are—

Mr. **Scheuer**. What Dr. Hedge was stating was they aren't so peripheral; they're very central, the human factors, the stress level, all kinds of psychosomatic phenomena that are felt and evidenced in an incredible variety of humans, thousands of them, perhaps, working in these buildings, and that that has to be contemplated as well as the quality of the air and the quality of the technology in the building.

Dr. **Janssen**. That's right. But the protocols that are used do a pretty good job of separating those factors to determine whether the factor is due to something physical in the system or whether it's one of these peripheral problems.

Mr. **Scheuer**. Can any of you give me some advice on what would be a cooperative research program brought by the Federal agencies that should be involved? It would have to be a multidisciplinary program involving all of these individual human factors you've talked about, as well as the technology in the building and the air quality in the building that could be measured, presumably quite accurately.

Which of the Federal agencies—If you were asked to create a consortium of Federal agencies that would design a research program to include all of the elements that you've discussed, both the physical and mechanical aspects of the building, as well as all of the human phenomena, which Federal agencies would you involve in this consortium of agencies that would design a very sophisticated research program to contemplate all the phenomena that you have addressed this morning?

You would include EPA, you would include OSHA? Tell me which agencies you would include.

Dr. **Janssen**. EPA, DOE, OSHA, probably the Department of Health—I'm not sure exactly which—Health and Human Services, and also the National Institute of Standards and Technology should be involved because they have a lot of on-hands testing of buildings and so forth.

But I think the first thing that ought to be done is to collect all of the anecdotal data from people who have been doing these sick building studies and start analyzing it to determine exactly what the patterns are.

Mr. **Scheuer**. Arthur Wheeler.

Mr. **Wheeler**. If I were in your position, I would put the sole burden on EPA and let them be the coordinator, but give them the authority for establishing such a program and not have a consortium at all. Because once you have a consortium, everybody is pointing at somebody else, and say the reason we haven't got it. But put the monkey on EPA's back.

Mr. **Scheuer**. Yes, you would have to have a lead agency, and you're suggesting that it rightfully should be the EPA. Still and all, shouldn't they be tapping the expertise and the insights of the other agencies that Mr. Janssen suggested?

Mr. **Wheeler**. You're proposed 1066 calls for exactly that, and I think that part of it is very good. It does indicate, though, cooperation with these other agencies rather than direction of the other agencies. I think that would be the one thing I would change.

Mr. **Scheuer**. Right.

Any final remarks from anybody? Yes, Mr. Wolfert.

Mr. **Wolfert**. Could I go back to one of your original questions about retrofitting these requirements into buildings?

Mr. **Scheuer**. Yes, indeed.

Mr. **Wolfert**. Mr. Wheeler stated correctly, if the air conditioning system or the ventilation system is designed to bring in these air quantities, it's probably not a big problem on the air-handling side to do that. You would have to, though, increase cooling capacities and heating capacities in those particular plants.

If the building did not have the adequate duct work installed presently, then you would have a tremendous expense to get those air quantities into a building. It's been my experience that in an existing building, to install those measures, is two to four times as expensive as the original installation cost, if it was done during the original design process and construction process.

Mr. **Scheuer**. Well, again, that wouldn't bother me, presuming that cost, as expressed in annual maintenance and so forth, that can be passed on to the tenants, it's a societal cost. And it wouldn't bother me if I knew that something constructive were being achieved.

Mr. **Wolfert**. I would agree with that.

Mr. **Scheuer**. Right now, this has been a very frustrating experience. You men are all brilliant, you have expressed yourself with great professionalism and depth of knowledge, and what you've told me is that we're sort of groping in the dark and we may be laying obligations, substantial and expensive obligations, on building owners that may have little or anything to do with the causes of illness or severe discomfort, that they come from a variety of other factors that Dr. Hedge has outlined. It seems to me that we ought to consider this seriously.

It's been an extremely interesting hearing, and it seems to me that you've indicated areas in which we ought to do a great amount of very sophisticated, multidisciplinary research.

Any other final word? All right. I thank you very much. We've gone way over time, and the only reason is that it's been so fascinating and such a stimulating discourse. I thank you all very much for your patience.

The hearing is hereby suspended, adjourned at the call of the chair.

[Whereupon, at 1:50 p.m., the hearing was adjourned, subject to the call of the chair.]

APPENDIX

U.S. CONSUMER PRODUCT SAFETY COMMISSION

REPORT TO CONGRESS
ON
INDOOR AIR QUALITY

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EXECUTIVE SUMMARY

The Consumer Product Safety Improvement Act of 1990 requires the Commission to report to the Congress by May 15, 1991, on its activities to reduce exposure of individuals to indoor air pollutants. The report is required to contain:

- a discussion of the nature of indoor air quality hazards and their association with consumer products;
- the remedial measures, to the extent known, which may be taken to reduce such hazards;
- descriptions of past and current activities of the Commission in the area of indoor air quality;
- future activities planned by the Commission to address indoor air quality problems already identified; and
- the Commission's overall strategies and plans for identifying and remedying the hazards.

The quality of indoor air has a major impact on the health and well-being of consumers. Adverse health effects associated with indoor air pollutants include respiratory illness, neurobehavioral disorders, cancer and death. Reducing consumer exposure to indoor pollutants reduces risk and improves health and well-being.

Some population groups - older people, children and those of all ages who are in poor health - spend most of their time inside their homes. These people are particularly vulnerable.

The Congress has directed the Consumer Product Safety Commission to protect consumers from the unreasonable risks of injury and death associated with consumer products. Consequently, the Commission is often the first agency consumers contact when they have a problem. The Commission, almost since its inception, has been concerned with improving the quality of indoor air. It identified a number of consumer products that released air pollutants and acted, under its legislative authority, to reduce consumer exposure.

In the past, one of the ways the Commission reduced exposure was by eliminating an ingredient in a product. In some instances, industry reformulated products to eliminate an offending chemical. In other cases, the Commission promulgated a ban. And in cases where the product could be used safely, the Commission required labeling and prepared informational materials for consumers.

In the future, the Commission will build on the work it has begun by:

- cooperating with other federal agencies in collecting information and conducting research on various health and exposure aspects of indoor air quality;
- working with industry to encourage reformulation or redesign of products that release pollutants;
- where necessary, setting product standards or product bans to protect the quality of the indoor environment;
- developing improved techniques for measuring the quality of indoor air and identifying sources of pollution;
- encouraging industry development of systems which remove pollutants from the air of consumers' homes and recirculate cleansed air throughout the home environment; and
- providing information to industry and consumers on ways indoor air quality can be improved.

INDOOR AIR QUALITY
A REPORT TO CONGRESS

In 1990, more than 250 million Americans lived in 93 million households. Eighteen million were children under the age of five; 31.5 million were 65 years of age and over. By the year 2000, there will be more than 268 million people living in between 102 million and 110 million households.

The quality of air in these households has a major impact on the health and well-being of their occupants. Indoor concentrations of some pollutants greatly exceed the concentrations outdoors, even those for which ambient air quality standards have been set.

Consumer products used in the home may release a number of chemicals, particulates and biological pollutants. The effect on consumers of pollutants in the home environment is a function of a number of factors. For example, are consumers particularly sensitive to one or more of the substances? Do they have health conditions which are exacerbated by exposure to these substances? How long are they in the home? How many and in what concentration are the chemicals, particles and biological materials released into the home? Are there smokers in the home? Dampness due to flooded basements? Mildew? What is the temperature and humidity of the home? How often is the air exchanged with outside air? What is the quality of the outside air?

Some people spend as much as 80-90 percent of their time indoors. Children under five years of age, older people and persons of all ages who are in poor health may spend even more time indoors. An individual's health risk from a particular pollutant is related to the concentration of the pollutant in the environment, the length of time the individual is exposed, and the individual's susceptibility.

Some consumers may be more vulnerable. For example, asthmatics may be more responsive to pulmonary irritants. Newborns and very young children may be more susceptible to specific infectious organisms and carcinogens. Smokers can be as much as eight times more likely to develop lung cancer than nonsmokers.

The Commission has worked since its inception to protect consumers from illnesses and deaths associated with exposure to pollutants released from consumer products. While the Commission has made significant progress, there is more to be done.

The Commission's goal is to improve the quality of the air in homes and schools by eliminating or reducing the emissions from consumer products of substances which cause both acute and chronic health effects. This will be accomplished by working with industry, consumers and other Federal agencies to eliminate or reduce the emissions of these substances from consumer products.

The Commission's Legislative Authority

The Consumer Product Safety Act (CPSA) established the Consumer Product Safety Commission as an independent regulatory commission. The purposes of the act are:

- to protect the public against unreasonable risks of injury associated with consumer products;
- to assist consumers in evaluating the comparative safety of consumer products;
- to develop uniform safety standards for consumer products and to minimize conflicting state and local regulations; and
- to promote research and investigation into the causes and prevention of product-related deaths, illnesses, and injuries.

The CPSA also gave the Commission responsibility for the administration of four other statutes, including the Federal Hazardous Substances Act (FHSA).

The CPSA and the FHSA provide the Commission with the authority to engage in the broad range of activities required to protect the public from unhealthy indoor environments caused by indoor air pollutants.

The Commission has jurisdiction over the products and appliances and many of the building materials that contribute to indoor air pollution. Houses and other buildings are excluded from the Commission's authority by the legislative history and judicial interpretations of the CPSA. The Commission does, however, have jurisdiction over components of a dwelling, such as building materials and appliances, if two conditions are met:

- the product is produced or distributed as a distinct article of commerce, and
- the product is customarily sold or otherwise distributed to consumers, notwithstanding that a large portion of the product is distributed for industrial purposes.

The provisions of the CPSA and the FHSA give the Commission authority, when necessary, to

- ban a product;
- establish mandatory safety standards for products;
- recall products for repair, replacement, or refund;
- mandate warning labels for products;
- obtain product formulations from manufacturers; and
- cooperate in the development of voluntary product standards in order to address indoor air quality hazards.

The CPSA defines "consumer product" as

> any article which is produced or distributed for sale to a consumer or for the personal use of a consumer in or around the home, in schools, recreation, or otherwise," except as specified.

The FHSA requires labeling for household products that are "hazardous substances". Where labeling does not or would not adequately protect public health and safety because of the degree or nature of the hazard involved, the Commission has the authority to ban household products containing hazardous substances.

The FHSA defines a "hazardous substance" as including

> any substance or mixture of substances which (i) is toxic, (ii) is corrosive, (iii) is an irritant, (iv) is a strong sensitizer . . . if such substance or mixture of substances may cause substantial personal injury or substantial illness during or as a proximate result of any customary or reasonably foreseeable handling or use . . .

Products that are hazardous because they contain chronically toxic substances are also required to be labeled with the name of the chemical, the nature of the hazard, (such as "causes cancer" or "causes nervous system damage") and the steps to be taken to avoid exposure to the hazardous chemical.

The Commission has just proposed guidelines for manufacturers to determine if their products expose consumers to substances that cause nervous system damage or reproductive or developmental problems or cancer. The Commission's responsibilities in this area were enhanced by Congress in 1988 with the passage of the Labeling of

Hazardous Art Materials Act (LHAMA), Pub. L. No. 100-695, which amended the FHSA. Regulations proposed by the Commission in the Federal Register on April 17, 1991 to implement the LHAMA will remove any ambiguities regarding the declaration of chronic hazards on consumer product labeling.

The Quality of Indoor Air

The Commission's concern with the quality of indoor air is based on its authority over individual chemicals or substances released from consumer products.

As a result of the energy crisis of the early 1970s, millions of Americans began making their homes more energy efficient. The Federal government encouraged and supported these efforts, granting tax benefits to consumers who made expenditures to improve the fuel efficiency of their homes. Consumers added insulation, caulked leaks around doors and windows, installed storm doors and windows, and took other measures to reduce the flow of air into and out of their homes.

Reduced air exchange, often accompanied by increased humidity, trapped potentially dangerous substances inside the home. The Commission became concerned about both the short-term effects and the possible chronic toxicity of these substances.

These are some of the pollutants the Commission has identified, the consumer products with which they are associated and the adverse health effects that have been noted.

- Carbon monoxide (CO) is an odorless gas released into the environment as one of the products of combustion from fuel-fired heating and cooling equipment such as heaters, water heaters, portable heaters and central furnaces. CO is also released from burning charcoal and quickly reaches dangerous levels in areas with limited ventilation.

  CO poisoning is insidious because the symptoms associated with low levels of exposure can be confused with other common illnesses like flu. Depending on the level of exposure, CO can cause acute or chronic health effects or death. Each year, 200 CO poisoning deaths are associated with gas heating equipment. In 1990, 52 persons, mostly hunters and campers, died when charcoal-burning hibachis, grills and portable gas stoves were used in unventilated tents and campers.

- Nitrogen dioxide (NO_2) is a gas which is one of the products of combustion from kerosene heaters, unvented gas space heaters and gas ranges. NO_2 is a respiratory irritant which may also interfere with the immune system. Children and individuals with chronic respiratory illnesses are especially sensitive to exposure to NO_2.

- Benzene was used in paint removers and other consumer products. Benzene causes serious blood disorders, chromosomal abnormalities, leukemia and cancer.

- Trichloroethylene was a widely used organic solvent. Trichloroethylene causes cancer in laboratory animals.
- Glycol ethers were widely used in household cleaning products. When two of the glycol ethers were found to cause birth defects, their use was discontinued by industry.
- Volatile organic chemicals are released into the indoor environment from paints, paint strippers, aerosol sprays, cleansers, air fresheners and hobby supplies. Exposure to some of these chemicals, which include methylene chloride, perchloroethylene, toluene and xylene, can cause heart problems, kidney or liver problems or, in certain instances, cancer.
- Methylene chloride was the active ingredient in paint strippers and other products. Inhalation of methylene chloride vapors can cause heart problems in certain individuals and has been found to cause cancer in laboratory animals.
- Biological pollutants, such as bacteria, fungi (molds and mildew), and dust mites, grow and thrive in the indoor environment in a number of locations, most commonly in wet or moist walls, ceilings, basements, carpets and furniture. Another source of biological pollutants is portable household humidifiers especially when they are not properly cleaned. Exposure to these pollutants can cause respiratory allergic reactions and infections.

Other sources of indoor pollution may be part of the building structure and its contents. Some examples are:

- Formaldehyde may be released from particleboard or plywood which is part of the building structure, and from furniture and cabinets, durable press fabrics and glues. Foamed-in-place insulation may contain formaldehyde. Urea formaldehyde foam insulation (UFFI) is occasionally still marketed, although insulation installed five to 10 years ago is unlikely to still release formaldehyde. Formaldehyde, depending upon its concentration in the air, can cause watery eyes, burning sensations in the eyes, nose and throat, nausea, coughing, chest tightness, sneezing, skin rashes, and allergic reactions. Formaldehyde is also a carcinogen.

- Asbestos can be released from insulation, fire-proofing materials, vinyl flooring or acoustical materials if the materials are damaged or disturbed. Exposure to asbestos fibers can cause lung cancer and mesothelioma.

- Lead is released into the environment from lead-containing paint, particularly when old paint is removed from the walls and woodwork of homes. Exposure to lead can cause brain damage, impair mental function and retard physical development in children. The Department of Housing and Urban Development (HUD) recently reported to Congress that 57 million private homes have some lead-based paint and that 3.8 million of these constitute "priority hazards" to children. According to Dr. Louis Sullivan, Secretary of Health and Human Services, lead poisoning is the most common and societally devastating environmental disease of young children. In adults, lead poisoning can cause poor muscle coordination, nerve damage, hypertension and reproductive impairment. If pregnant women are exposed to lead, retarded development of the fetus can result.

What Has the Commission Done?

The Commission has worked, over the years, to improve indoor air quality by:

- removing from the market chemicals in consumer products associated with both acute and chronic health problems,
- conducting research on consumer products and environments to identify and characterize indoor air quality,
- developing methods for measuring a variety of household emissions and testing of consumer products for emissions,
- and providing information to manufacturers and consumers on indoor air quality problems and solutions.

A set of charts summarizing the Commission's activities is attached at Appendix A.

Since 1977, the Commission has used its authority under the CPSA and the FHSA to ban or, under section 15 of the CPSA, to remove from the marketplace products which were emitting pollutants. In addition, the Commission drew attention to the toxicity of some chemicals which resulted in industry voluntarily taking action to reduce or remove them from consumer products.

In 1977, the Commission, under sections 8 and 9 of the CPSA, banned the use of free form respirable asbestos in patching compounds and artificial emberizing materials. In 1978, using its authority under section 15 of the CPSA, the Commission removed from the marketplace hair dryers which were insulated with asbestos and could emit asbestos particles when in use. After the 1977 ban, the Commission negotiated with the industry to accomplish the voluntary removal of asbestos from consumer products. As an interim measure for those few remaining products, the Commission also enforces product labeling during the phase-out period prior to the banning of asbestos by the Environmental Protection Agency.

The Commission proposed in 1978 to ban benzene as an intentional ingredient or as a contaminant in most consumer products. As a direct result of the Commission's proposed ban and before the ban could be effected, industry reformulated products to eliminate the use of benzene. The Commission withdrew the proposed ban.

In 1980, the Commission proposed a regulation requiring manufacturers of urea formaldehyde foam insulation (UFFI) to alert purchasers of the possible acute and chronic health effects associated with exposure to formaldehyde. The acute health effects included eye, nose and throat irritation and shortness of breath. The possible chronic health effect was cancer, since formaldehyde had been shown to be a carcinogen in laboratory animals.

The Commission banned the use of UFFI in residences and schools in FY 1982. The Commission received and analyzed complaints from consumers, death certificate files and data from the National Electronic Injury Surveillance System (NEISS). After receiving 2,400 complaints involving more than 6,200 people reporting adverse health effects after installation of urea formaldehyde foam insulation (UFFI) in their homes and conducting several hundred in-depth investigations, the Commission, in FY 1982, voted to ban the use of UFFI in homes and schools. Although the ban was subsequently overturned in the courts, the Commission's actions drew so much public attention to the adverse health effects of exposure to UFFI that industry has, to a large extent, discontinued using it.

In 1983, the Commission began an evaluation of formaldehyde emitted from pressed wood products. Data were collected on emission rates and estimates were made of consumer exposure to formaldehyde emitted from resins and glues in pressed wood products. The Commission evaluated the hazards associated with consumer exposure to formaldehyde from pressed wood products. When industry was given the results of these studies, they reformulated the resins to reduce formaldehyde emissions.

The Commission proposed a regulation in 1978 to ban unvented gas-fired space heaters to avoid the hazard of poisoning or asphyxiation from carbon monoxide. In 1980, the Commission promulgated a standard requiring these heaters to be equipped with a sensor to shut off the heater when the oxygen level became depleted so the heater would not produce high levels of carbon monoxide. The heaters were required to be labeled warning of the potential hazard. In 1984, the Commission revoked the standard because a voluntary standard had been developed with which high levels of industry compliance were expected.

In FY 1982, an indoor air quality (IAQ) priority project brought together the separate IAQ projects. Each year the Commission selects as priority projects the most serious hazards which it believes it can effectively address. In making these decisions, the Commission considers the frequency and severity of injuries associated with a product, the probability of chronic illness or future injuries, the costs and benefits that would result from Commission action, the unforeseen nature of the risk, the vulnerability of the population at risk (such as children and the elderly) and the likelihood that the public will be exposed to the hazard.

As part of its 1982 IAQ priority project, the Commission began investigating the problem of indoor air quality by conducting a pilot testing program in 50 homes to identify and measure the presence of certain known pollutants. The homes were monitored over several seasons and measurements were made of chemicals in the air that were thought to come from consumer products.

The Congress, recognizing the need for additional research into indoor air quality problems, gave the Commission an increase in staff equal to two full time equivalents and $485,000 in contract dollars for indoor air quality research. The Commission, in December 1986, submitted to Congress a research plan to use the monies for the following projects:

- Continue research toward determining the magnitude of the health risk from indoor pollutants, particularly the contribution of biological contaminants for which little residential data existed;
- Develop and validate exposure models; and
- Develop standardized test methods in support of voluntary standards.

The results of the work the Commission did on these projects are described below.

By 1986, the Commission had become aware of health hazards associated with airborne biological contaminants, both allergens and pathogens, from products such as humidifiers, vaporizers, and air conditioners. The Commission's concern with this problem led to participation in a study conducted under the direction of the Harvard School of Public Health, referred to as the Harvard Six Cities Study, and to an interagency agreement with Oak Ridge National Laboratory.

As part of the Harvard Six Cities Study, the Commission monitored the presence of biologicals in residences in three of the six cities, utilizing ongoing field studies and building on data already collected. The University of Michigan studied the presence of biologicals. The Harvard School of Public Health assessed the association between biologicals, health effects and housing characteristics.

The study produced information on the prevalence of biological organisms in selected domestic interiors. It also provided valuable data on various monitoring methods useful in standardizing monitoring protocols. From this study, the Commission learned that microbial air quality data vary from one city to another and that extrapolation of indoor or outdoor data from one city to another is presently not possible. The study also showed that, in the homes studied, indoor air levels did not greatly exceed outdoor levels nor were the types of microorganisms found indoors substantially different from those found outdoors. Where indoor levels are substantially greater than outdoor levels and/or where types of indoor organisms are different from those outdoors, the homes are said to be contaminated.

Under an interagency agreement with Oak Ridge National Laboratory, the Commission conducted a study to assess the extent to which the use of portable household humidifiers added to the biologicals indoors. The study demonstrated microbial build up in all types of household humidifiers that were not regularly cleaned.

In the laboratory study, ultrasonic and cool mist humidifiers readily emitted biologicals from their reservoirs. The output from steam and evaporative type units was not significant.

The Commission supported the development of a model by the Lawrence Berkeley Laboratory to predict exposure to indoor air pollutants on a nationwide basis. The model is not widely used since it cannot be validated with existing data.

The Commission tested four available filter devices believed to have the potential to remove volatile organic compounds (VOCs) from the air of consumers' homes. When the filter devices were found to be inadequate, the Commission tested on-the-market filter media to see if they could remove VOCs from the air. The filter materials did not have sufficient absorbent properties.

In 1986, the Commission learned that methylene chloride had been found to cause cancer in animals. The Commission issued a proposed rule declaring products containing methylene chloride to be hazardous substances due to a risk of cancer from inhalation of methylene chloride vapor. The Commission promulgated an enforcement policy which resulted in hazard labeling of 13 products regarding potential carcinogenicity. The Commission is currently reevaluating the use of and associated risks for three of the 13 products currently labeled which are of most concern due to the possibility of exposure to high concentrations of methylene chloride.

One of the most significant contributions the Commission has made in solving the problem of indoor air pollution is the development of methods for identifying and testing emissions. The Commission developed two testing facilities. One measures the amount and rate of volatile organic emissions from products such as air fresheners and carpets. The other measures emissions from a variety of combustion appliances. While the techniques used to measure emissions from various types of products differ, the indoor environment affecting those emissions is frequently the same. Air exchange rates, temperature, and humidity play a significant role in the rate at which a chemical is released into and removed from the indoor air. This in turn affects the concentration of the chemical that is achieved within a defined space. Through the use of a computer model, developed at the National Institute of Standards and Technology (NIST) and supported jointly by the Commission, the Department of Energy (DOE), and the Environmental Protection Agency (EPA), it is now possible to predict concentrations of specific emissions in a home environment and to estimate the level of risk to the dwelling's occupants.

Another standardized test method developed by the Commission measures nitrogen dioxide emitted from kerosene heaters. This test will be the basis for an Underwriters Laboratory (UL) voluntary standard for kerosene heaters. An American National Standards Institute (ANSI) Working Committee has been established to work on a voluntary standard for unvented space heaters using the same test method.

The Commission provided information to the public in a series of press releases and informational booklets. Many of the booklets were prepared in cooperation with other agencies and with industry. These are some of the Commission's indoor air quality information products.

Safety alerts. Safety alerts on the following topics were distributed nationwide to media, consumer protection offices, health departments and others.

- Humidifiers
- Methylene Chloride
- Lead Paint in the Home
- Art and Craft Material Labeling

Brochures. Brochures on the following topics were developed to be distributed by health departments, the American Lung Association (ALA) and the Commission's regional offices. A set of these brochures is attached at Appendix B.

- Asbestos in Your Home. This brochure was first put out in 1982 in cooperation with the EPA and was updated in 1990 in cooperation with EPA and the ALA. This brochure is regarded by the community familiar with asbestos as the definitive work on the subject of safe handling of asbestos-containing materials in the home.
- Biological Pollutants in Your Home. This brochure was prepared in 1990 in cooperation with the ALA.
- The Inside Story: Guide to Indoor Air Quality. This brochure was prepared in cooperation with EPA.
- Update on Formaldehyde. This comprehensive guide to the health effects, indoor air levels and sources of formaldehyde in the home was issued in 1990.
- Combustion Products. This brochure is scheduled for release in 1991.

Video News Releases. These releases are broadcast by satellite to news departments of television stations and have been viewed by four to eight million television viewers.

- Methylene Chloride (1987)
- Humidifiers (1989)

Community Outreach to Organizations.

- In 1990, indoor air quality packets were provided to 3,500 state health departments. The health packets were developed in 1990 in cooperation with EPA under contract with the National Environmental Health Association (NEHA). A copy of the packet is attached at Appendix C.

Interagency Cooperation

The Commission cooperates with other Federal agencies in identifying and characterizing indoor air pollutants. The Committee on Indoor Air Quality (CIAQ), established in 1983, is the primary interagency group. The Commission co-chairs the CIAQ along with the Department of Health and Human Services (HHS), the DOE and the EPA.

CIAQ agencies, in cooperation with the National Institute of Environmental Health and Safety (NIEHS), funded a study on the effects on children of indoor air pollution. Initially the study, conducted by the Harvard School of Public Health, was going to look at the effects on children of outdoor air pollution. When indoor air pollution was found to be a serious problem, the focus of the study was expanded. The Harvard Six Cities Study, referred to earlier, sought to answer the question: Is there any correlation between measured pollutant levels in homes and the respiratory health of children?

Each of the CIAQ agencies participated in collecting the data for the study. The NIEHS monitored the respiratory health of children, and the amounts of particulates and nitrogen dioxide in the homes. The Commission sponsored more intensive measurements of nitrogen dioxide levels in 25 of the homes that used kerosene heaters and funded the measurement of biological pollutants in homes in three of the six cities studied. EPA sponsored the measurement of formaldehyde levels. All of these data were sent to the Harvard School of Public Health for use in their study. Analysis of the data is still ongoing.

In another example of interagency cooperation, the Centers for Disease Control (CDC) sent the Commission data from its various surveillance projects. The CDC has a network of physicians who call in to report health problems they believe to be part of a pattern of illness for which they do not have an explanation.

These data indicated health problems that appeared to be associated with indoor air quality, such as hypersensitivity pneumonitis and Legionnaire's disease. Still another example of interagency cooperation is the work on both asbestos and methylene chloride conducted jointly by the Commission and the EPA.

The Commission's Indoor Air Quality Goal
What the Commission Will Do

The Commission's goal is to improve the quality of the air in homes and schools by eliminating or reducing the emissions from consumer products of substances which cause both acute and chronic health effects.

The Commission's objectives and the actions the Commission will take to meet this goal are:

1. Reduce carbon monoxide deaths from non-fire related causes by at least 50 percent over the next five years.

There are approximately 163 million people in 63 million households who use natural or LP gas for heating, water heating, cooking and clothes drying. These people could be exposed to unsafe levels of CO resulting in some level of CO poisoning.

Modern furnace design affords some protection to consumers. In November 1987 the ANSI standards were modified with Commission participation to require blocked-vent safety shutoff systems. The vent safety shutoff system is a thermal sensor which shuts off the furnace if the flue gets blocked. Normally, carbon monoxide gases go out the flue. If the flue is blocked, carbon monoxide will go into the living area.

The blocked-vent safety shutoff system does not provide total protection from CO poisoning, however. Furnaces manufactured before 1987 remain in service and are not equipped with the blocked-vent safety shutoff system. Furthermore, the blocked-vent safety shutoff system cannot protect against diversion of fumes to vents attached to other gas appliances sharing the ventilation system. Therefore, the Commission believes that both the blocked-vent safety shutoff system and CO detectors are needed and that, together, they will substantially reduce deaths from CO poisoning.

UL, with the encouragement of the Commission and industry, is developing a standard for CO detectors which would require an alarm based on exposure. The Commission's FY 1992 and FY 1993 priority projects will evaluate existing CO detectors, assessing their durability, reliability, accuracy, failure modes and maintenance needs. The Commission will recommend that model building code groups adopt requirements for the installation of reliable and effective CO detectors in new construction, and the Commission will cooperate with voluntary standards organizations to modify detectors which require improvement.

The Commission believes that widespread use of CO detectors will provide significant protection to consumers in homes with combustion appliances. In FY 1993 the Commission will work for adoption of requirements for the use of CO detectors by state and local building code groups. Consumer programs will be developed encouraging installation of CO detectors in existing homes.

The Commission has been petitioned to require the labeling statement on bags of charcoal to add specific language warning of the danger of carbon monoxide poisoning if the charcoal is burned in an unventilated area. The Commission will address this petition during FY 1991. In FY 1992, the Commission will continue evaluating the technology for lessening the hazard of CO emissions from portable heaters. Advances in combustion technology and improved safety labeling will be pursued.

2. Reduce childhood respiratory illnesses associated with exposure to nitrogen dioxide, biological pollutants and particulates.

While the relationship between childhood respiratory illnesses and air pollutants has been demonstrated, only limited and inconclusive data are available on the frequency and severity of these illnesses.

In order to achieve this objective, two approaches are required. The first is to find out whether the present concentration of NO_2 resulting from the use of unvented combustion appliances should be lowered. The second is to determine the frequency and severity of childhood respiratory illnesses associated with these pollutants.

In 1986, the Commission accepted an emission rate from unvented gas space heaters and kerosene heaters which would result in a concentration of 0.3 parts per million (ppm) in the living area. This level was supported by a review by EPA's Clean Air Scientific Advisory Committee (CASAC) of literature available before 1985.

Exposure to NO_2 can be controlled in two ways: reducing emissions from known sources and increasing ventilation in the affected area. In FY 1992, the Commission will evaluate levels of NO_2 resulting from the use of combustion appliances. If they are too high, the Commission will work with voluntary standards organizations to lower emissions and will advise consumers with older equipment on increasing the ventilation in areas where these appliances are used.

Biological pollutants and particulates often work together. Particulates may act as carriers for other gases, polycyclic aromatic hydrocarbons, bacteria and dust mite parts. Some biological pollutants can cause serious lung disease, such as Legionnaire's disease. Dust mites and their parts have been identified as a serious source of allergic reactions in young children and particularly in children with asthma.

The frequency and severity of childhood respiratory illnesses associated with these pollutants could be determined with a case-control study targeting children living in homes which contain fuel-fired appliances. The study will include monitoring pollutants in homes and assessing the health of child-occupants through questionnaires and clinical evaluations. The results of this study will enable the Commission to identify ways to protect children. The resources needed to conduct this study will be identified in FY 1993. The Commission's efforts will not be limited to problem definition studies but will include identifying and evaluating practical solutions to existing problems.

3. Stimulate development by industry of air cleaning systems which eliminate known pollutants from indoor air.

One reliable way in which the quality of indoor air can be improved is when homes and schools are equipped with systems which can clean and recirculate cleansed air throughout the indoor environment. However, heating, ventilating and air conditioning (HVAC) systems are not the same in all parts of the country. An HVAC system which would be suitable for use in the eastern part of the country would be different from one used, for example, in the southwest.

The technology to achieve clean indoor air is largely available but has not been adapted for residential use. The Commission can support development of these systems by providing uniform performance standards to assure consumer utility and assisting consumers in identifying systems that meet their needs.

The Commission estimates that industry will develop residential HVAC systems which can cleanse and recirculate air by the end of the decade. Sales and installation of new equipment may take another two to four years. At the same time, industry can be developing air cleaning systems as add-ons for use with existing heating and air conditioning systems.

4. Reduce the risk of consumers being exposed to substances in consumer products which cause cancer, birth defects and neurological damage.

The Commission will continue to identify and, wherever possible, remove from consumer products substances that have the potential to cause cancer, harm fetal development or damage the reproductive system or the nervous system. In instances where this is not possible, consumers will be provided with instructions on the safe use of the products. The Commission will act to assure that uniform standards and definitions are in place to prevent confusion in the marketing of these products.

The Commission has issued proposed guidelines for manufacturers to determine if their products require labeling. Manufacturers of art materials are required to submit documentation to the Commission, upon request, for evaluation by the Commission to ensure proper labeling.

The Commission will work with the entire consumer product industry to reduce consumer exposure to volatile organic chemical emissions from household products. Innovative approaches that eliminate nonessential emissions will be encouraged. Maintaining consumer safety and product utility are essential parts of the effort to improve the quality of indoor air.

The Commission will provide consumers with comprehensive and accurate information on the hazards of household chemicals. This information will be used by consumers to improve purchase choices, allowing market forces to encourage consumer demand for safer products. Consumers will become more aware of their responsibility to use potentially harmful products in the safest possible manner.

5. Reduce the incidence of lead poisoning in children.

The Commission's first use of its banning authority under Section 8 of the CPSA occurred in 1976 when household paint containing lead in excess of 0.06% was banned. Use of such paint on toys and other articles intended for use by children and on furniture articles for consumers was also prohibited. A major concern in limiting lead in paint was oral ingestion. Dust from deteriorating paint or from paint removal, however, can present an indoor air hazard.

Advances in scientific knowledge have demonstrated that levels of lead previously considered to be safe can have devastating effects on the mental and physical development of children. Over the next five years, the Commission will eliminate, to the extent necessary, the use of lead in consumer products.

Effective action to reduce lead poisoning requires close cooperation among the Federal Government, state and local governments and private groups. The Department of Health and Human Services (HHS) and the EPA have prepared and sent to Congress strategic plans for preventing lead poisoning. The Commission's strategic plan is being developed and will be completed by the beginning of FY 1992.

These are some of the things the Commission may do during the next five years.

- Determine whether the acceptable level of lead in paint should be lowered. During FY 1991, the Commission may publish in the Federal Register a notice of regulatory investigation to find out whether the acceptable level of lead in paint should be lowered. If the results of the regulatory investigation support taking this action, the Commission could publish an advance notice of proposed rulemaking in FY 1992 to lower the acceptable level of lead in paint from 0.06 percent.

- Identify consumer products containing lead and determine whether they can be used safely, that is without lead being introduced into the indoor environment.

- Develop and disseminate materials telling consumers how to deal with lead paint safely and how to use other lead-containing consumer products safely. Labeling of paint and surface preparation equipment and materials and disseminating information to consumers about safe removal practices will reduce the amount of lead getting into indoor air from existing lead in paint in homes.

- Evaluate the safety and effectiveness of new products designed to encapsulate lead-based paint on interior walls and trim as part of in-place management of lead-based paint in consumers' homes.

- Continue working closely with HUD, the CIAQ, other Federal, state and local agencies and industry to identify solutions to the problem of lead poisoning.

6. Provide information to industry and consumers on improving the quality of indoor air.

Workers' health complaints led to studies on the quality of indoor air in commercial buildings and offices leading to identification of the "sick building" syndrome. More recently, attention has turned to whether the air in consumers' homes can present similar problems.

Information on indoor air quality is dynamic. Many aspects of residential air quality have been and continue to be studied. Some studies measure and quantify the presence of chemicals, biological substances and particulate materials in indoor air, many of which are associated with consumer products. Epidemiologic studies try to identify and correlate the association between the quality of indoor air and the health of residents, particularly young children. Risk assessment is used to predict both acute and chronic risk to consumers as a result of exposure to air pollutants in their homes.

What does the Commission do for consumers? One important function of the Commission is to act as a conduit for information. The Commission explores ways to apply the results of studies of poor indoor air quality to conditions in homes and schools. The Commission tells consumers about the results of studies on health effects of consumer products and how the results of these studies affect them. Whenever possible, the Commission provides consumers with practical, low cost measures for reducing indoor air problems in their homes. There are many things consumers can do as a normal part of their everyday activities to improve the quality of their indoor air. Some will take substantial effort. Others can substitute for activities which unwittingly increase the indoor air pollution problem.

The Commission also works with industry and voluntary standards groups to support development of consumer products which do not contribute to indoor air pollution. The Commission tests products which are intended to clean indoor air as well as those which may be degrading the quality of indoor air. For example, filters intended to remove VOCs from the air were tested by the Commission and found to be inadequate. The Commission tested portable humidifiers and found them to be a source of biological pollutants. The Commission is working with industry to provide consumers with cleaning instructions which could eliminate humidifiers as a source of indoor air pollution.

The Commission conducts research into those aspects of indoor air quality that are particularly important to consumers. For example, reliable and reproducible test methods are needed for identifying and measuring the emissions of a variety of chemicals from consumer products. Information is needed about the effects of prolonged exposure to low levels of a substance or the possible synergistic effects of various substances. These are the areas of information collection, analysis and evaluation in which the Commission has years of experience.

The Commission will broaden its collection of information on adverse health effects that may be associated with consumer products. Beginning in FY 1992, the Commission will consider mounting a national campaign encouraging consumers, industry and health care practitioners to report instances of illnesses they believe to be related to indoor air pollution in homes and schools. This campaign could include placards placed in health care facilities encouraging people to contact the Commission through its toll-free 800 Consumer Hotline telephone number. Analysis and evaluation of these data will assist the Commission in identifying patterns of health effects.

The Commission will continue receiving data from CDC and other sources. These data will be merged with other data providing the Commission with an expanded information base for identifying specific health effects as well as trends in indoor pollution-related illnesses. Another benefit of the data collection and analysis will be the identification of consumer behavior patterns that may require modification.

The Commission's Capabilities and Areas of Expertise

The Consumer Product Safety Commission is a small agency with broad experience specific to consumer products and the diverse technical expertise and facilities necessary to undertake and successfully complete indoor air quality projects. Because the Commission can undertake most projects with its own staff and facilities, the expenditures required to complete projects are modest when compared to other agencies.

Several of the Commission's unique capabilities are especially suited to furthering the study of indoor air pollution.

- Comprehensive death certificate files identify deaths from CO poisoning and facilitate linking the death with the product source of the CO.
- Trained professional investigators gather cause-and-effect information about indoor air pollution through on-site evaluation and in-depth investigations.
- An existing network of medical examiners routinely provide information on products which contribute to deaths, including CO poisoning.
- An established network of contacts in state and local governments provides information on product hazards, including indoor air quality issues, and cooperate on conducting investigations.
- Effective policies and procedures for cooperating with voluntary standards organizations have involved the Commission in the development of 35 different standards, with 11 completed in the past year.

The Commission is expert in testing and evaluating consumer products. The test facility established for emission testing of combustion products is ranked among the best in the nation. The small-chamber test facility, currently being used to measure emissions from consumer products like air fresheners and carpets, is state-of-the-art. The Commission has also used large environmental chambers for verification testing.

The Commission is experienced in evaluating indoor air exposure based on experimental chamber measurements, modeling of consumer environments and field measurements of selected pollutants. The modeling has been verified by controlled experiments and field testing. The Commission published guidelines in the Federal

Register on April 17, 1991 on how to assess exposure from consumer products and use the data for risk assessment. These guidelines were published as a result of the Labeling of Hazardous Art Materials Act and are intended to apply to all products under Commission jurisdiction.

The Congress has given the Commission broad powers to improve indoor air quality. The Commission uses these powers to improve the quality of consumers' lives. Continued Congressional direction and support assure the use of the Commission's capabilities to reduce or eliminate indoor air pollutants.

APPENDIX A

Charts Summarizing the Commission's Indoor Air Quality Activities

Table I		ASBESTOS		
YEAR	**AREA**	**PROJECT DESCRIPTION**	**COMPLETED ACTIVITIES**	**CURRENT ACTIVITIES**
1978	Asbestos Product Ban	Ban on the use of asbestos in certain consumer products. Advance notice of proposed rulemaking (ANPR) articulated policy of ending "non essential" uses of asbestos.	Reduced unnecessary consumer exposure to asbestos. Removed asbestos from products such as patching and spackling compounds. Response to ANPR led to the end of asbestos use in hundreds of consumer products, from dishwashers to flooring.	
1980	Hair Dryers	Section 15 action on hair dryers containing asbestos.	Recall or replacement of hair dryers containing asbestos that could be released during use.	
1982	Asbestos Consumer Information	Published "Asbestos in the Home" booklet.	Brought together the best available information on asbestos problems in the home and presented this information in a manner the consumer could use.	
1986	Asbestos Enforcement Policy	Enforcement of product labeling for the few remaining products containing asbestos.	During the ban and phase out of asbestos, consumers are warned that a product contains asbestos.	
1985-1986	Asbestos exposure	In-house measurements of potential asbestos exposure.	Based on measurements, were able to establish that asbestos used in the home, if undisturbed, did not result in measurable exposure.	
1989	Conference on asbestos in the home	Brought together leading experts on the various aspects of asbestos problems in schools, homes and other residential situations.	Provided a forum for presentation of the latest information on asbestos. Panel of experts evaluated data and issued report.	

Table I		ASBESTOS		
YEAR	**AREA**	**PROJECT DESCRIPTION**	**COMPLETED ACTIVITIES**	**CURRENT ACTIVITIES**
1990	Asbestos Consumer Information	Revised "Asbestos in the Home" booklet.	Presented information from 1989 conference in a manner the consumer could use.	

Table II		VOLATILE ORGANIC COMPOUNDS		
YEAR	**AREA**	**PROJECT DESCRIPTION**	**COMPLETED ACTIVITIES**	**CURRENT ACTIVITIES**
1976-	VOCs in Consumer Products	Voluntary elimination or reduction of consumer exposure to VOCs in consumer products.	Beginning in 1976, CPSC has worked with industry to reduce or eliminate exposure to harmful chemicals in consumer products. This program has been very successful and has resulted in the voluntary reformulation of many products to reduce exposure to such chemicals as benzene, ethylene glycol ethers, perchloroethylene, freon, tricholoroethylene, and methylene chloride.	Continue cooperation with industry.
1980-1983	UFFI	Evaluation of consumer exposure to formaldehyde due to use of Urea Formaldehyde Foam Insulation (UFFI).	Based on studies which showed that consumers could be exposed to high concentrations of formaldehyde due to UFFI, CPSC banned UFFI. By the time the court, on judicial review, overturned the ban, use of UFFI was insignificant.	
1982	Formaldehyde in products	Preliminary screening of consumer products for formaldehyde emission.	Identified pressed wood, textiles, and preserved biological specimens as consumer products which can emit formaldehyde. Developed programs to assess textile exposures. Changed industry practice to reduce exposure from preserved biological specimens.	

Table II		VOLATILE ORGANIC COMPOUNDS		
YEAR	**AREA**	**PROJECT DESCRIPTION**	**COMPLETED ACTIVITIES**	**CURRENT ACTIVITIES**
1983-	Formaldehyde in pressed wood products	Evaluation of consumer exposure to formaldehyde from pressed wood products. Respond to petition from Consumer Federation of America (CFA).	Established reliable test methods for formaldehyde emissions from pressed wood products. Verified emission model. Predicted exposure and risk. Denied CFA petition as not technically feasible.	Develop options for reducing levels of formaldehyde in homes. Continue working with industry to establish voluntary standard to protect consumers. Verify or improve industry test method.
1985	Formaldehyde in textiles	Formaldehyde used to impart permanent press characteristics in textiles.	Investigated dermal absorption of formaldehyde and emission from fabrics. Determined not carcinogenic from dermal exposure. Industry practice changed resulting in reducing levels to a level below which there is concern that the population could be sensitized.	
1989-1990	Formaldehyde consumer information	Formaldehyde booklet.	Published a booklet informing consumers of the status of knowledge.	

Table II		VOLATILE ORGANIC COMPOUNDS		
YEAR	AREA	PROJECT DESCRIPTION	COMPLETED ACTIVITIES	CURRENT ACTIVITIES
1988-	Expand FHSA labeling and LHAMA	Criteria and guidelines for determining when consumer products present hazards of cancer, neurotoxicity, or reproductive and developmental toxicity.	In November 1988, the FHSA was amended, enhancing CPSC authorities for art materials and requiring issuance of guidelines and criteria for chronic hazards. Proposed guidelines and definition of chronic toxicity provide uniform federal requirements for when products subject to the FHSA require labeling to warn consumers of hazards of cancer, neurotoxicity, or reproductive or developmental toxicity. This labeling will assist consumers in preventing contamination of the indoor air.	Review comments and issue final regulation. Review criteria, methodology and effectiveness of regulation. As needed, work with manufacturers for re-formulation.
1986-	Methylene Chloride	Evaluate potential hazards of methylene chloride from consumer products.	Perform exposure assessments. Develop exposure and risk assessments. Require labeling under FHSA. Conduct use survey to evaluate effectiveness of labeling.	Use data to develop strategies for labeling and evaluation of effectiveness.

Table II		VOLATILE ORGANIC COMPOUNDS		
YEAR	**AREA**	**PROJECT DESCRIPTION**	**COMPLETED ACTIVITIES**	**CURRENT ACTIVITIES**
1989-	Carpets	Collect consumer complaints and investigate emissions	A two-fold effort to identify problems and chemicals associated with carpets was undertaken. Initiated in-depth reports on consumer complaints. Conducted small chamber testing of carpet samples and samples from various phases of manufacture. Completed preliminary screening.	Continue measurements through 1992. Depending on exposure and health assessment, work with industry to reduce emissions.

Table III		COMBUSTION APPLIANCES		
YEAR	AREA	PROJECT DESCRIPTION	COMPLETED ACTIVITIES	CURRENT ACTIVITIES
1976-	Substantial Product Hazards	The Commission, under Section 15 of the CPSA, has required removal, repair or refund of defective appliances by the manufacturers of combustion appliances.	Combustion products which the Commission finds to be "substantial product hazards" due to CO poisoning or other serious pollutants have been and will be fixed or removed from the marketplace.	Use the data gathered under this section of CPSA to identify generic problems that need to be addressed. Continue to remove defective combustion appliances from the marketplace.
1982-	UVGSH Poisoning (CO and NO_2)	Develop method for measuring CO emissions in chamber. Evaluate effectiveness of oxygen depletion sensors (ODS). Develop requirement for ODS's on unvented gas heaters.	Banned unvented gas space heaters (UVGSH) without ODS's. Withdrew ban because compliance with voluntary standard for ODS was excellent and CPSC did not wish to preempt local bans.	Evaluate NO_2 emissions from UVGSH. Correlate hood testing with chamber testing. If resources permit, evaluate other potential pollutants from UVGSH. Encourage improvement in reduction of pollutants and/or venting.
1982- 1983	Vented Room Heaters	Recommendation to change ANSI Z21 voluntary standard to protect against CO poisoning.	ANSI Z21 Standard for vented room heaters was revised to require blocked-vent safety shutoff systems to protect against acute CO poisoning.	
1983	CO Detector	Project undertaken to determine developmental status of low-cost residential CO detectors.	Determined that at time of the study there were no low-cost residential CO detectors capable of rapidly and reliably warning at low levels.	

Table III		COMBUSTION APPLIANCES		
YEAR	**AREA**	**PROJECT DESCRIPTION**	**COMPLETED ACTIVITIES**	**CURRENT ACTIVITIES**
1983-	Kerosene Heaters	Develop instrumentation for measurement of pollutant emissions from kerosene heaters in the CPSC test chamber. Develop a hood measurement system that could be used for certification testing. Correlate hood and chamber measurements.	CPSC has developed an outstanding capability and facility for combustion appliance testing. Testing has been performed for CO, CO_2, NO_X, SO_X, and acid aerosols. Working with the UL task force, a test method has been developed and the rationale and level for NO_2 emissions have been selected.	Implement voluntary standard in FY 1993. Supply information to consumers.
1984- 1985	CO Detector	Laboratory examination of commercially available and developmental CO detectors.	Results indicated that solid state CO detectors generally perform to manufacturers' claims, but may be susceptible to false alarms if set point is too low.	
1987	Central Furnaces	Recommendations to ANSI Z21 voluntary standard to develop standard requirements for blocked vent safety shutoff systems to protect against CO poisoning.	Standard was amended in 1987 to require a vent safety shut off switch. Testing of two furnaces indicate significant protection offered by vent safety shut off switch.	

Table III		COMBUSTION APPLIANCES		
YEAR	AREA	PROJECT DESCRIPTION	COMPLETED ACTIVITIES	CURRENT ACTIVITIES
1989-	CO Detectors	Develop standard for residential CO detectors.	UL, at behest of CPSC and others, is drafting new CO detector standards based on dose response data.	In FY 1993, evaluate detector in laboratory. Encourage model codes to include CO detectors in new construction. Encourage adoption of requirements in local codes and improve consumer use rates.
1991-	UVGSH	Using the equipment and methodology developed for kerosene heaters, develop the hood/chamber correlation for CO and NO_2. Develop test method and levels for certification testing.	Test facility has been upgraded and tests have been made more automatic to increase accuracy and lower cost of tests and analysis.	Develop voluntary standard for NO_2 in 1993. Apply technology to other combustion appliances, e.g. portable appliances which account for up to 25 deaths a year.
1991-	Petition to Label Charcoal	Petition requests additional labeling on charcoal to warn consumers that use of charcoal in a poorly ventilated area can cause death from CO poisoning.	Staff will address petition and determine the merits of the request.	If justified, petition will be granted and revised labeling will be proposed as a regulation.

Table IV		BIOLOGICALS		
YEAR	AREA	PROJECT DESCRIPTION	COMPLETED ACTIVITIES	CURRENT ACTIVITIES
1986	Biological Pollutants: Kingston-Harriman Field Study	Identify sources and concentrations of biological pollutants present in residential indoor air (coordinated with Harvard Six Cities Study).	Data collected from homes in eastern TN revealed generally higher indoor concentrations of fungi and bacteria, some of which may cause respiratory symptoms.	
1986	Biological Pollutants: Home Humidifiers	Identify generation and emission of biological pollutants from home humidifiers.	Studies carried out in the laboratory and in homes where humidifiers were in use showed that reservoirs of cool mist and ultrasonic portable humidifiers were readily contaminated with bacteria. Reservoirs of furnace-attached steam and evaporative type units also contained considerable numbers of organisms, but bacterial emissions into the air from the few units tested were insignificant.	

Table IV		BIOLOGICALS		
YEAR	AREA	PROJECT DESCRIPTION	COMPLETED ACTIVITIES	CURRENT ACTIVITIES
1987	Biological Pollutants: Sampling for biological pollutants	Collect and characterize biological pollutants in selected residences in Portage, WI, Steubenville, OH, and Topeka, KS using rigorous biological monitoring methods (coordinated with Harvard Six Cities Study) Contract with Dr. Harriet Burge, University of Michigan.	Currently, no single sampling method will fully characterize an indoor environment; additional investigations of the variation of bacterial levels are needed; samples should be taken in the main living area, the basement, and outdoors; suitable bacterial sampling methods need to be developed; and dust mite particles in homes may cause acute asthma attack in vulnerable populations.	
1987	Biological Pollutants: Examination of Indoor Microbiological Contamination, Housing Characteristics and Health	Determine if associations exist among measured microbiological concentrations (from UM study), housing characteristics, and respiratory health symptoms of children residing in these homes. Contract with Dr. John Spengler, Harvard School of Public Health.	Few associations were found between specific biologicals and respiratory health symptoms.	

Table IV		BIOLOGICALS		
YEAR	**AREA**	**PROJECT DESCRIPTION**	**COMPLETED ACTIVITIES**	**CURRENT ACTIVITIES**
1987-	Biological Pollutants: Emission of Mineral Particulates and bacteria from home humidifiers	Determine potential of home humidifiers to contribute significant levels of mineral particles and bacteria to the indoor environment.	Preliminary results indicate that minerals normally present in water supply are readily sprayed into the air by cool mist and ultrasonic humidifiers not fitted with a demineralization filter; warm mist humidifiers emitted very small amounts. Concentrations that may be generated by humidifier operation in home are below airborne levels of minerals permitted by OSHA in the workplace for normal workers; effect on sensitive populations is unknown. Cool mist and ultrasonic units can emit bacterial toxins at levels sufficient to cause the respiratory ailment, Humidifier Fever.	Work with industry to develop cleaning and maintenance instructions for the safe use of humidifiers.
1988	Biological Pollutants: Consumer Safety Alert and Video News Release	CPSC issued safety alert in December 1988 and Video News Release in February 1989 to inform consumers of the steps they should take to use humidifiers safely.	Alert and News Release Video reached four to eight million consumers.	

Table IV		BIOLOGICALS		
YEAR	AREA	PROJECT DESCRIPTION	COMPLETED ACTIVITIES	CURRENT ACTIVITIES
1989	Biological Pollutants: Workshop with American Lung Association (ALA) and production of joint booklet, "Biological Pollutants in Your Home"	Conducted workshop with ALA using expert panel to develop guidance to consumers on how to assess and decrease indoor air pollution exposures in home from biological pollutants.	Brochure - "Biological Pollutants in Your Home".	

Table V		VOLUNTARY STANDARDS AND IAQ
Organization	**Committee**	**CPSC Interest**
ASHRAE	ASHRAE 62-19xx VENTILATION	This standards committee sets minimum ventilation standards and establishes maximum concentrations of pollutants.
	ASHRAE 145P "Test method for assessing the performance of gas phase air cleaning methods"	CPSC sponsored studies at LBL and NIST on removal of gaseous pollutants from indoor air. One conclusion of these studies was the need for the development of a test method which not only took into account the absorption properties of the material but also the desorption.
ASTM	ASTM D22.05 Indoor Air Quality	CPSC is a member of this committee. The committee develops the standard test methods for measurement of pollutants in indoor air. Since these methods can and do affect CPSC's ability to enforce the acts under which it operates, participation is important.
UL	Kerosene Heater Task Group	Develop NO_2 emission standard for kerosene heaters
ANSI	Formaldehyde in pressed wood products	Standard, as developed, lacks necessary test method verification.
ANSI	ANSI Z21 Gas Appliances	CPSC has participated in this committee for many years and has been responsible for many of the improved safety standards.

U.S. DEPARTMENT OF COMMERCE
STATEMENT OF
RICHARD N. WRIGHT, DIRECTOR, BUILDING AND FIRE RESEARCH LABORATORY
NATIONAL INSTITUTE OF STANDARDS AND TECHNOLOGY
FOR SUBCOMMITTEE ON ENVIRONMENT
HOUSE COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY

July 1, 1991

INTRODUCTION

Mr. Chairman and Members of the Subcommittee, I am pleased to submit this statement on H.R. 1066, the "Indoor Air Quality Act of 1991."

The National Institute of Standards and Technology (NIST) has been conducting building research since 1920 and research in the area of indoor air quality since 1980. Current indoor air quality activities in NIST's Building and Fire Research Laboratory (BFRL) are conducted with the support of other federal agencies in order to assist them in fulfilling their missions.

Comfort, productivity, and, in some cases, the health of building occupants are being affected by the levels of numerous pollutants inside today's buildings. Indoor air quality complaints appear to be increasing, though the reasons for this increase are not well understood. Various explanations have been offered including lower building ventilation rates, increased numbers and amounts of chemical substances being used in buildings, and increased awareness on the part of building occupants of environmental hazards. However, current understanding of the nature, extent and causes of indoor air quality problems is indeed limited. Research at NIST and elsewhere is addressing these important questions to enable a rational assessment of indoor air quality conditions and to develop considered prevention and problem-solving strategies. While NIST does not have a role in developing policy responses to indoor air quality problems, or in conducting health effects assessments, our technical expertise in building performance and in developing reliable measurement techniques and standards has contributed and will continue to contribute to addressing the indoor air quality problem.

NIST INDOOR AIR QUALITY RESEARCH PROGRAM

The NIST indoor air quality research program is carried out primarily in the Building and Fire Research Laboratory. The basic goals of the program are to develop and demonstrate measurement techniques for assessing indoor air quality and ventilation system performance in buildings, to acquire building performance data such as indoor contaminant levels and ventilation rates, to further the physical understanding of indoor contaminant levels and air movement in buildings and the factors affecting the same, and to develop and apply computer models to predict contaminant levels and airflow patterns in buildings. In the area of measurement technique development, NIST has been the internationally recognized leader in the measurement of air change rates and ventilation system performance in commercial buildings. We have been conducting these measurements for over 10 years using automated measurement techniques developed at NIST. Our database of ventilation measurements and our understanding of ventilation issues in commercial buildings is truly unique. We have also developed automated systems to continuously monitor contaminant concentrations in buildings. The simultaneous measurement of ventilation rates and contaminant levels in office buildings has been a unique contribution of NIST and has enabled the development of many important insights, particularly concerning the levels of carbon dioxide, carbon monoxide and volatile organic compounds in buildings. NIST has also been a leader since the early 1980s in the development of computer models to predict airflows and contaminant levels in buildings. The development of programs such as TARP, AIRNET and the CONTAM series has provided state-of-the-art computational techniques to research and building assessment professionals. The results of NIST research has been instrumental in the development of many American Society for Testing and Materials (ASTM) and American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE) test standards, and our involvement in the standard writing activities of these organizations continues.

The Chemical Science and Technology Laboratory at NIST has a long history of expertise in the measurement of air contaminants as well as the development of reference materials, standards and the evaluation of test methods. As part of this program NIST provides over 90 analyzed gases as standard reference materials, as well as permeation tubes and standards for outdoor air quality and clinical diagnostic measurements. While most of this work has been directed towards outdoor air contaminants, these efforts and the associated expertise are also applicable to the measurement of indoor air contaminants.

There are currently several important projects in NIST's indoor air quality research program. As part of a multi-year interagency agreement with the General Services Administration (GSA), NIST is conducting ventilation and air quality assessments in new federal office buildings. These studies involve the installation of NIST-developed test equipment for at least one year, beginning before occupancy, in order to monitor ventilation rates and contaminant levels in new office buildings as a means of studying air quality performance issues in new buildings. GSA is interested in the adequacy of their current design and operation practices for providing acceptable air quality and whether these practices need to be modified in the future. These long-term monitoring efforts are unique in the indoor air quality research field and have been internationally recognized. Such monitoring has been completed in the Portland East Federal Building in Portland, Oregon, and is in progress in the new Federal Records Center in Overland, Missouri. A new monitoring effort is in the beginning stages in the new Long Beach Federal Building in California.

NIST continues to be active in the development of techniques for use in the measurement of ventilation system performance in the field. As part of a long-term agreement with the Department of Energy to study ventilation and infiltration in large buildings, NIST is currently developing procedures to evaluate ventilation effectiveness in the field. While a certain level of ventilation is required in a building to maintain adequate levels of thermal comfort and to reduce contaminant concentrations, ventilation effectiveness is a concept used to describe the ability of the ventilation system to distribute this amount of ventilation air uniformly throughout the building. Techniques are needed to measure ventilation effectiveness in mechanically ventilated office buildings in order to assess the adequacy of current air distribution systems. In a somewhat related project, NIST is working under an interagency agreement with the Bonneville Power Administration (BPA) to conduct a comparison of different techniques for measuring ventilation rates in commercial buildings. While a variety of techniques is available and advocated to assess commercial building ventilation rates, the accuracies of many of these procedures have never been determined in the field. Tracer gas testing of ventilation rates has been used by NIST since the early 1980s and serves as the de facto measurement standard. Other measurement procedures include direct airflow measurement in ventilation ductwork and carbon dioxide mass balances. While these non-tracer gas procedures are certainly faster and less expensive, serious questions exist regarding their applicability in the field and the potential for their misuse. In order to develop accuracy estimates and to investigate the applicability of these procedures, NIST is conducting a comparison of the various measurement procedures in the BPA Headquarters Building in Portland, Oregon. NIST will install an automated tracer gas measurement system in the building and conduct simultaneous ventilation measurements using tracer and non-tracer gas procedures.

While NIST and others have been developing computer models to predict indoor contaminant levels, the experimental validation of these predictive models has been inadequate. In order to address this need for model validation, NIST has designed and is constructing a multi-zone, experimental facility to validate indoor air quality models. This project will enable the development of estimates of predictive errors of current indoor air quality models and identify those areas where further modeling efforts are needed.

COMMENT ON H.R. 1066

We believe that current federal research and technical activities are contributing to a better understanding of the problems associated with indoor air quality and that legislation is unnecessary at this time.

We would like to offer a few technical comments on this section:

This section specifies the HVAC systems of new public or commercial buildings be designed to provide a minimum of 20 cubic feet per minute of outdoor air per occupant. It is important to recognize that a ventilation standard alone will not necessarily provide good air quality in the face of many common pollutant sources. Source control, building operation, and other factors merit consideration. It is also important to recognize that a ventilation requirement for design does not assure actual ventilation. Our measurements of office building air change rates, which constitute about almost all of the existing data, shows that 40% of the actual air change rates are below design values for minimum outdoor air intake.

Regarding the requirement of 60 cfm per person where smoking is permitted, a very strong case can be made that if smokers and nonsmokers share the same space, then this level of ventilation will not provide for the comfort and health of the nonsmokers. The only effective engineering solution is to allow smoking only in designated areas and to exhaust these spaces to the outdoors.

The requirement of 0.75 air changes per hour at 25 Pascals, if it is to remain, should be clearly stated as a building envelope airtightness requirement. We believe that buildings should be constructed with tight envelopes for several reasons, air quality included, and that significant changes in current design and construction will be required to accomplish this. Relying on envelope leakage to meet ventilation requirements is bad technical practice; its rate and distribution cannot be controlled, and the incoming air is unconditioned and unfiltered. We recommend ASTM E779 as the relevant test standard for making these airtightness measurements. Also, the only industry that has developed an airtightness standard is the curtain wall industry. This group, the American Architectural Manufacturers Association (AAMA), has an airtightness standard at 75 Pascals, not 25. To be consistent with the only industry airtightness standard, the reference pressure should be changed to 75 Pascals, in which case the numerical value also needs to be changed. Probably more important, designing a building to be this airtight is different from constructing one. All office buildings are designed to be tight, but very few are. Our test data show that office building envelopes are just as leaky as typical U.S. homes, in terms of the leakage per square foot of wall area. The design and construction practice for achieving real office building airtightness is yet not in place. We are currently developing building envelope design guidelines for GSA specifically directed towards improving the airtightness of federal office buildings.

Consumer Federation of America

STATEMENT FOR THE RECORD OF

MARY ELLEN FISE

PRODUCT SAFETY DIRECTOR

CONSUMER FEDERATION OF AMERICA

before the

SUBCOMMITTEE ON ENVIRONMENT

OF THE COMMITTEE ON SCIENCE, SPACE & TECHNOLOGY

OF THE HOUSE OF REPRESENTATIVES

on

INDOOR AIR QUALITY

May 9, 1991

Mr Chairman and Members of the Subcommittee, Consumer Federation of America is pleased to submit this statement for the record on the impacts of indoor air pollution and the appropriate federal response in addressing this major health problem. CFA is a national consumer advocacy organization, representing over 240 state, local and national organizations with a combined membership of more than 50 million consumers.

Indoor air quality is a key health and safety priority for CFA. For many years now, we have perceived indoor air pollution as the number one hidden health threat to our nation, where people are estimated to spend as much as 90% of their time indoors.

While there has been increased attention by federal agencies in researching and addressing indoor air issues, we believe that the general public's understanding of this issue is limited. In a recent national CFA survey, testing representative samples of the U.S. population, several questions were included to test practical knowledge of consumers on a variety of indoor air quality issues. The sample population answered only 58% of the indoor air questions correctly. On one question regarding common sources of indoor air pollution, many respondents were not aware, for example, that humidifiers (32%+) and paneling (28%+) are potential sources; only 24% answered this question correctly.

In light of the significant adverse human health consequences of indoor air pollution, CFA strongly supports passage of comprehensive indoor air quality legislation this Congress and we urge this Subcommittee to make such enactment a high priority. Indoor air quality legislation introduced in past Congresses, as well as H.R. 1066 introduced this session by Representative Kennedy, have had extremely modest price tags compared to the high costs associated with poor indoor air quality. According to Environmental Protection Agency (EPA) estimates, indoor air pollution conservatively costs our nation between $4.4 and $5.4 billion per year. Hence, in purely economic terms, the $53.5 million required by H.R. 1066, is more than justified in this era of unprecedented federal deficits.

Before addressing specific provisions of H.R. 1066 and other indoor air related legislation, I would like to underscore the need for passage of an action-oriented piece of legislation. In the past, there has been much discussion touting the non-regulatory nature of pending indoor air legislation. While a research bill was, perhaps, appropriate in 1985 when Congress initially began focusing on this issue, we believe that time has passed. Indeed, there is a continued need for research; much remains to be learned, for example, about the synergistic effects of contaminants and about multiple chemical sensitivities. However, there are areas where federal regulation and action is appropriate today. Measures to address environmental tobacco smoke, radon, as well as standards to limit consumer exposure to pollutants from certain products, should be explored.

Indoor Air Quality Legislation

CFA supports the provisions in H.R. 1066, the "Indoor Air Quality Act of 1991." The legislation is a comprehensive federal approach that provides direction for research where needed and initiates regulatory measures that are now feasible in order to protect consumers.

While we were pleased to see the inclusion of a contaminant emissions product labeling provision (Section 16), we believe this section needs to be strengthened. As currently written, only products that "pose a significant adverse human health threat through indoor air contaminant emissions," as identified by EPA, would be required to carry such labeling. CFA believes this language is overly broad and should be amended to require products that "potentially pose a health threat" to be labeled. The current provision would more likely than not be ineffective in getting a large group of products quickly labeled, so as to assist consumers in making purchase decisions. We believe the consumer education provision contained in this section is vitally important to the effectiveness of a product labeling requirement and we urge the Subcommittee to support the importance of educating the public on the need to select products that can reduce their exposure to indoor air contaminants.

CFA is particularly pleased to see the inclusion of other action-oriented initiatives in H.R. 1066. We believe the requirement that public and commercial buildings meet building ventilation standards is very important (Section 15). Similarly, the requirement that the Occupational Safety and Health Administration review the need for indoor air quality workplace standards (section 17) is timely and needed.

The Indoor Air Contaminant Health Advisories (section 7) could play an effective role in educating the public about indoor air pollutants. We are pleased that section 7 (a)(2) will "in no way limit or restrict the application of requirements or standards established under any other Federal law."[1] This provision should be strengthened to give EPA the authority to establish standards (under this law) to limit consumer exposure to such contaminants, rather than having to make the case that some other federal law is applicable any time it wants to regulate an indoor air pollutant. [2]

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[1] It is important that Congress make clear that actions by agencies with existing authority, such as the Consumer Product Safety Commission, not be usurped.

[2] The specific potential response actions included in the response strategy required in Section 8 similarly should not be limited to existing statutory authority.

We are pleased that EPA has already begun work to establish an Indoor Air Quality Clearinghouse (as required by section 13 of H.R. 1066). Congressional endorsement and oversight of this important consumer information program should continue.

Environmental Tobacco Smoke

CFA was pleased to learn of the Secretary of Health and Human Services' recent request that the President sign an executive order prohibiting smoking in all federal buildings. Passive smoking is a cause of disease, including lung cancer in healthy nonsmokers. In 1986, the Surgeon General concluded that the simple separation of smokers and nonsmokers with the same air space may reduce, but does not eliminate, the exposure of nonsmokers to environmental tobacco smoke (ETS). Recent reports, combining fatalities from lung cancer and heart disease, estimate that as many as 53,000 deaths result annually in the United States from passive smoking. CFA believes that Congress should examine federal strategies and requirements, beyond the airline smoking ban, to protect non-smokers from ETS. Implementation of a workplace smoking ban, beyond the possible federal building executive order, should be required and would be an appropriate addition, in our opinion, to a federal indoor air quality bill.

Radon

Radon continues to pose a serious health threat to Americans, even taking into account the newly revised cancer estimates provided by the recent National Academy of Sciences study. An estimated 16,000 lung cancer deaths will occur each year as a result of homeowner exposure to radon.[3] But while EPA estimates that radon is the number one environmental problem based on population cancer risk, the agency estimates that less than 5% of our nation's homeowners have acted to identify or correct radon problems.

Despite the federal government's efforts to educate the public, there is still widespread ignorance regarding the adverse effects of radon and the means by which it can be detected. The CFA survey, described above, asked two specific questions about radon. We learned that 17% of the respondents thought radon gas can be a problem in houses because it can cause high blood pressure in the occupants; 15% thought it can be a problem because it can cause unpleasant odors; and 6% believe radon can cause discoloration of walls and furnishings. Regarding the means to detect radon gas in homes, 45% of those questioned answered incorrectly: 22% of the respondents said radon can de detected by unusual odors; 12% answered that radon can be detected by stains on walls; and 11% replied that readings on a Geiger counter can detect the presence of radon in homes.

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[3] This figure represents one estimate based on the National Academy of Sciences study. EPA has not finalized its revised radon cancer estimate.

Given the level of cancer risk posed by radon, CFA believes there is a need for an expanded federal response. CFA supports the provisions embodied in legislation introduced by Representative Markey in the 101st Congress. That legislation, the "Radon Awareness and Disclosure Act", would require that all houses financed via federally related mortgages be tested for radon and that the results be made available to potential purchasers. In addition, federally owned houses would have to be tested for radon before they are sold and the results made available to potential purchasers. CFA believes that the institutionalization of radon disclosure through residential real estate transactions will not only automatically inform prospective home purchasers, but also serve as a catalyst for remediation of high risk properties. Just as the results of a termite inspection or structural inspection have become the basis for negotiable bargaining points in a home sale, so too could radon test results.

Another key feature of the Markey bill is a requirement that school buildings identified as being in areas having higher than average risks of radon exposure be tested for radon and the results of such testing be made available to parents, teachers and others. Loans and grants for testing and mitigation are provided for.

The legislation also would establish a mandatory program to assure that products and services provided to the public for the measurement of radon meet minimum performance criteria. The program would be paid for by user fees levied on those who manufacture products or provide services covered by the program. H.R. 1066 contains a nearly identical mandatory program establishing minimum performance criteria.

CFA believes that any minimum performance criteria program should be strengthened by providing for penalties for non-compliance. Making this program mandatory and imposing fines for violations would, in our estimation, help assure that consumers are protected. Consumer confidence in making a purchase decision, in a technical area in which they have little or no ability to protect themselves, would be bolstered.

Finally, we support the legislation's reauthorization of the indoor air abatement provisions of the Toxic Substances Control Act and, in particular, the state grants programs which encourages and assists states in establishing radon programs. We recommend that the Subcommittee consider these radon provisions in its deliberations on how to address the risk of cancer from radon.

IAQ Marketing

While the findings regarding adverse health effects from indoor air pollutants have become available over the past several years, we are now beginning to see commercial marketers attempting to entice consumers to use products and services to address indoor air problems. While the marketing of such products and services is not inherently bad, it represents a maturation of the indoor air movement and the opportunity for consumer fraud and deception.

The success and proliferation of "green marketing" (for products that are purportedly environmentally safe) leads us to believe that indoor air marketing will not be a temporary flash in the pan. One major mail order catalogue that markets a tabletop air cleaner begins its advertisement with a bold headline reading "End Indoor Air Pollution." [4] Another catalogue's ad copy begins "Since the EPA began reporting indoor pollution levels up to 10 times worse than outdoors, many people have bought air filters to protect their health." The ad also states that the product "removes harmful gasses and particles" and has an accompanying box that lists volatile gasses, including "misty vapors of volatile chemicals, such as formaldehyde, tobacco smoke, and other organic chemicals."[5] While we do not assert that this product does not perform as marketed, we do know that doubts have been raised about the ability of portable air cleaners to remove volatile organic compounds from indoor air environments.[6]

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[4] See 1991 Sharper Image catalog ad for an Ionizer that removes particulates, one category of indoor pollutants.

CFA believes that the federal government, in addition to performing research and taking action on the pollutants themselves, must also analyze and assure that products sold to the public to combat indoor air pollution are effective.

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[5] See Self Care Catalog advertisements for the AllerMed Airstar Home Air Purifier and the AllerMed Desktop Air Purifier, marketed for office use.

[6] A study of four types of air cleaners to evaluate their ability to remove volatile organic compounds (VOCs) and nitrogen dioxide (NO2) was conducted by Lawrence Berkeley Laboratory for the U.S. Consumer Product Safety Commission in 1988. Only two of the four air cleaners tested removed NO2 and five VOCs; both units contained proprietary catalysts in their filter assembly, suggesting that "activated charcoal alone is not sufficient for the removal of gaseous pollutants." None of the cleaners tested removed dichloromethane. In addition "a repeat experiment with one of the air cleaners indicated the possibility of decreased effectiveness for gaseous pollutant removal." Finally, the tests did not evaluate the cleaners' effectiveness in removing pollutants during long-term use with a constant source of gaseous pollutants. According to CPSC, "Preliminary results indicate the possibility that a filter may lose considerable cleaning potential over a short (150 hours) period of use." See CPSC Memorandum, "Investigation of selected portable air cleaners for removing nitrogen dioxide and volatile organic compounds," April 6, 1988. A study by the National Institute of Standards and Technology also raised some questions about air cleaners, stating "gaseous contaminant removal devices which utilize physical adsorbers may not be practical for cleaning indoor air. The contaminant adsorbed onto the filter slowly elutes out of the filter when the contaminant level in the upstream air drops below the previous level or drops to zero." NIST, Internal Report 89-4119, "A Method for Measuring the Effectiveness of Gaseous Contaminant Removal Filters," Bal M. Mahaja.

In conclusion, we believe that the magnitude of the indoor air quality problem in this country is clear and the benefits to be recognized by an active program to reduce consumer exposure are substantial. CFA urges this Subcommittee to consider and promptly report out a comprehensive indoor air quality legislative package.

VENTILATION RATES IN OFFICE BUILDINGS

Andrew Persily
ASHRAE Member

ABSTRACT

The ventilation rate of an office building impacts the building air quality in terms of both thermal comfort and pollutant levels. Although office building ventilation systems are generally designed to provide specific amounts of ventilation under given conditions of weather and occupancy, the actual ventilation rates can be very different from the building design values. These differences between design and performance occur for a variety of reasons involving the design, installation, maintenance, and operation of the equipment, as well as interactions between the ventilation system and the building structure. Actual, measured ventilation rates in office buildings are required to compare the ventilation performance to design rates and ventilation standards, and to provide realistic inputs for models that predict pollutant levels, estimate pollutant exposures, and calculate thermal loads in buildings.

The National Institute of Standards and Technology (NIST, formerly the National Bureau of Standards) has been studying ventilation in office buildings for several years. This research has included the measurement of ventilation rates in 14 office buildings for periods on the order of one year, and has produced a data set of about 3000 ventilation measurements under a range of weather and building operation conditions. These data are a unique source of actual ventilation rate measurements in office buildings, and are the subject of this paper. Although measurements in only 14 buildings are insufficient to make generalizations regarding the impact of building age, construction, ventilation system type, and building location, these data do provide an indication of current practice. Although the ventilation rates vary considerably among the buildings and for each individual structure, many of the buildings have ventilation rates below recommended levels and/or design values during significant portions of the year.

INTRODUCTION

Air exchange is required in buildings in order to provide acceptable air quality in terms of indoor contaminant levels and thermal comfort. Although a specified level of air exchange does not guarantee acceptable air quality without the control of pollutant source strengths, ventilation standards and guidelines exist for most building types. For example, ASHRAE Standard 62, Ventilation for Acceptable Air Quality (ASHRAE 1989), specifies minimum levels of outdoor air intake for various space types. This standard is based on maintaining a comfortable interior environment, free from contaminant irritation and adverse health effects. It cannot, however, guarantee the maintenance of acceptable indoor air quality in the presence of unusually high contaminant sources. The ASHRAE standard specifies 10 L/s (20 cfm) per person in general office space with different recommendations in spaces such as conference rooms, reception areas, and bathrooms. HVAC design specifications for office buildings, in addition to specifying the airflow rates for each air-handling system, specify the minimum amount of outdoor air intake for these systems. These minimum amounts are generally based on some guideline, such as the ASHRAE standard.

In recent years, air exchange rates have been measured in several office buildings using tracer gas techniques (Persily and Grot 1985). The National Institute of Standards and Technology (NIST) has made measurements of air exchange in 14 office buildings, monitoring each building over about one year and making more than 3000 air exchange measurements. This paper summarizes the results of these measurements and compares the results to recommended levels of ventilation and to each building's minimum outdoor air intake specifications. In most of the office buildings studied, the measured air exchange rates are below recommended levels and/or design values during a significant portion of the building's occupied hours.

OFFICE BUILDING VENTILATION

All of the buildings discussed in this paper, and most modern office buildings in North America, are mechanically ventilated. The purpose of these ventilation systems is to provide conditioned air in order to maintain the interior air temperature and relative humidity at comfortable levels for the building occupants, as well as to maintain appropriate conditions for equipment and materials within the building. In addition, mechanical ventilation is intended to provide sufficient outdoor air to keep various indoor contaminants at acceptable levels. The net air exchange rate of an office building includes both the outdoor air intake associated with the mechanical ventilation system plus the rate of infiltration of outdoor air through the building envelope.

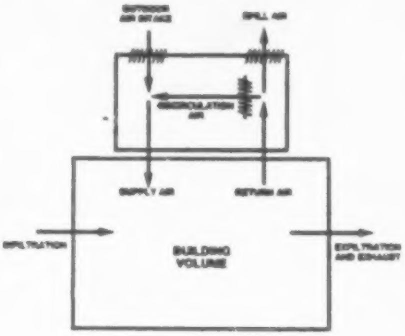

Figure 1 Schematic of a building ventilation system

National Institute of Standards and Technology, Gaithersburg, MD.

TABLE 1

Basic Building Information

Building	Year of Construction	Number of Stories	Floor Area (m²)
A	1974	7	71,000
B	1987	7	46,000
C	1989	15	28,000
D	1984	3	12,100
E	1984	3	12,100
F	1981	7	66,400
G	1962	5	14,000
H	1977	2	1,900
I	1978	6	18,600
J	1978	4	6,900
K	1972	5	3,600
L	1977	15	20,700
M	1975	4	5,300
N	1981	6	48,500

The rate of air exchange associated with a mechanical ventilation system (see schematic in Figure 1) is determined by a control system that varies the position of outdoor air intake, recirculation, and exhaust dampers within the air-handling system, and may also vary the fan airflow rates. There are a wide variety of air-handling systems and associated controls, but the systems in modern North American office buildings are generally of two basic types—constant volume and variable air volume (VAV). In a constant-volume system, the supply fan always moves the same amount of ventilation air and the temperature of this supply air is varied to meet the space-conditioning load within the building. In these systems, the amount of outdoor air intake is modulated by varying the position of the intake, recirculation, and exhaust dampers. Regardless of the amount of outdoor air intake, these dampers are always supposed to be positioned such that the supply airflow rate minus the return airflow rate is maintained at a constant level. This difference is intended to provide make-up air for toilet and other exhausts, and to maintain a slight positive pressure across the building envelope to control infiltration. These damper positions may be modulated by an automatic control system that responds to changes in indoor and outdoor air temperature and humidity, or they may be controlled manually by the building operator.

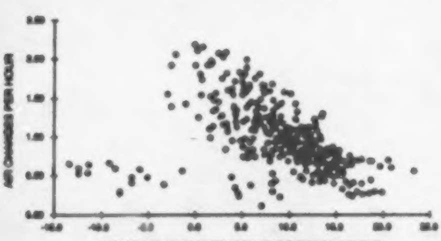

Figure 2 Air exchange rate vs. indoor-outdoor temperature difference for Building B

TABLE 2

Description of the Buildings Mechanical Ventilation Systems

Building	Supply Fan Capacity		Minimum Outdoor Air Intake		
	Air changes per hour	(cfm/ft²)	Air changes per hour	(cfm/ft²)	Percent of Supply Air
A	*	*	*	*	*
B	3.0	(.61)	*	*	*
C	1.7	(.24)	1.70	(.24)	100%
D	4.3	(.92)	0.72	(.15)	16%
E	4.3	(.92)	0.72	(.15)	16%
F	4.1	(.82)	*	*	*
G	2.9	(.63)	*	*	*
H	3.1	(.77)	0.42	(.10)	13%
I	2.5	(.43)	*	*	*
J	3.1	(.67)	1.82	(.40)	60%
K	5.5	(1.78)	0.90	(.29)	16%
L	3.8	(1.27)	0.36	(.12)	9%
M	2.4	(.80)	0.53	(.17)	21%
N	2.8	(.55)	0.36	(.07)	13%

* Information unavailable.

In variable-air-volume systems, the supply air temperature is kept constant and the supply airflow rate into the building is varied to meet the space-conditioning load. VAV systems are more common in newer buildings for reasons of reduced energy consumption and better control of local environmental conditions. The outdoor air intake control in VAV systems is essentially the same as in constant-volume systems, in that damper positions modulate in order to vary the air intake rate. Regardless of the mode of operation, both types of systems are always supposed to supply the minimum amount of outdoor air specified in the ventilation system design.

There are basically three modes of outdoor air intake control, corresponding to hot, cold, and mild outdoor air temperatures. Figure 2 is a plot of the air exchange rate data for Building B (one of the buildings discussed in this paper) vs. the indoor-outdoor air temperature difference. During hot weather, the amount of outdoor air intake is generally minimized to control the space-conditioning load within the building. During mild weather, outdoor air may be used to cool the building (a so-called economizer cycle), although some building air-handling systems are not equipped to take advantage of such "free-cooling." Most systems cut back the outdoor air intake to a minimum level during very cold weather in part to protect the heating and cooling coils in the air-handling systems from freezing.

In addition to the intentional outdoor air intake through the ventilation system, the net air exchange rate of a mechanically ventilated building also includes unintentional infiltration of air through leaks in the building envelope. The amount of envelope infiltration depends on the envelope airtightness and the strength of the infiltration driving forces, i.e., indoor-outdoor air temperature differences, wind, and mechanical equipment operation. In the design and operation of most modern, mechanically ventilated office buildings, the rate of envelope infiltration is generally assumed to be negligible. In fact, measurements and modeling of air exchange in office buildings has shown that envelope infiltration rates are often the same order of magnitude as the rates of intentional outdoor air intake (Persily 1985; Persily and Norford 1987). Although the envelope infiltration rate of an office building may be large enough to meet the outdoor air intake requirements of that building, infiltration air should not be relied upon for ventilation since its rate cannot be predicted, the incoming air is neither conditioned nor filtered, and there is no control over the distribution of this air within the building.

The air exchange characteristics of every building are unique due to differences in outdoor air intake controls, system operation schedules, envelope airtightness, and interior configuration. These factors determine the air exchange rate of a building at any given time and the distribution of air exchange rates over time. As mentioned above, the air intake rate through the mechanical ventilation system is determined by the time of day and season, as well as by the weather. The envelope infiltration rate is also determined by the weather, as well as by the operation of the mechanical ventilation system (itself a function of time and weather). Therefore, in order to characterize a building's air exchange performance, many air exchange measurements are required over a range of outdoor environmental conditions and times of day and season. The air exchange rate during minimum outdoor air intake conditions is of particular interest in characterizing air exchange in a building. The distribution of the building's air exchange rates over a year, specifically the amount of time that the building operates at this minimum level of ventilation, is also important.

DESCRIPTIONS OF THE BUILDINGS

This section provides a brief description of each of the 14 buildings studied by the NIST, including information on their air-handling systems, outdoor air intake controls, and specified design levels of minimum outdoor air intake, if available. These buildings are denoted as Buildings A through N, and Table 1 presents some basic information for each building. All but one of these buildings are less than 20 years old, and they range in floor area from about 2000 to 70,000 m^2 (about 22,000 to 750,000 ft^2). These are the total conditioned floor areas of the buildings (including corridors and lobbies), as opposed to rentable or occupiable floor areas. Buildings A and B, and G through N are federal office buildings, while Building F is a state office building. Buildings C through E are privately owned, although Building C is leased to the federal government. All of the buildings contain predominantly office space, with Building A containing some laboratories.

Basic information on the mechanical ventilation systems for each of the 14 buildings is presented in Table 2. All of the buildings have VAV systems, except for Buildings C and K, and all of the VAV systems employ economizer cycles. Most of the VAV buildings have constant-volume air handlers serving some of the smaller areas within the buildings, such as lobbies. Building C has a constant-volume system with 100% outdoor air intake, with no capability of recirculating air. Building K also has a constant-volume system. The amount of outdoor air intake in the building is modulated manually, with the building operator adjusting this proportion based on the interior and exterior environmental conditions.

Table 2 lists the supply fan capacity and the minimum outdoor air intake rate for each building, where available, in units of air changes per hour (ach) and in cfm/ft^2. The minimum outdoor air intake as a percentage of the total supply air is also given. These quantities are based on the mechanical equipment specifications for each building. The fan capacity in the VAV systems is the maximum capacity, which may not necessarily be realized in practice. The fan capacity in air changes per hour is simply the specified airflow rate divided by the building volume. The volume used is the total floor area from Table 1 multiplied by the ceiling height. In all buildings except C, this ceiling height includes the return air plenum due to the fact that return air is recirculated in all of these buildings. In Building C there is no return air plenum and the ceiling height of the occupied space is used. For all of the buildings except Building K, the fan capacity is between about 2 and 4 ach. The supply airflow rate per unit floor area is between 0.5 and 1 cfm/ft^2 in most of the buildings, with Building C below this range and Buildings K and L above it. The minimum outdoor air intake rate is generally between 1/3 and 1 ach. The specifications for Building J yield a minimum outdoor air intake rate of 1.82 ach, which is probably an error in the specifications. Building C has a minimum outdoor air intake rate of 1.7 ach, but since this building always operates at 100% outdoor air intake, this number is reasonable. Other than Building C (with 100% outdoor air intake) and Building J (with a suspected error in the ventilation specifications), the outdoor air intake for all of the buildings is between about 10% and 20% of the supply airflow rate.

AIR EXCHANGE MEASUREMENT TECHNIQUE

The air exchange rates in these buildings were measured using the tracer gas decay technique. This technique has been used for many years in both residential and commercial buildings to determine air exchange rates (ASTM 1983; Hunt 1980; Persily 1988). In this procedure, a harmless and nonreactive tracer gas is released into the building and mixed thoroughly with the interior air. Once the tracer gas concentration within the building is uniform, one monitors the decay in tracer gas concentration over time. The rate of decay of the logarithm of concentration is equal to the air exchange rate of the building during the time of the test. It is crucial that the tracer gas be uniformly mixed with the interior air such that the tracer gas concentration within the building can be characterized by a single value. If these conditions of uniform concentration are not achieved, then the measurement results are not valid.

In these measurements, sulfur hexafluoride (SF_6) was injected into the building supply fans in a manner that facilitated achieving a uniform tracer gas concentration within the building. The tracer gas was then allowed to mix for a period from 20 minutes to one hour, depending on the building. Different amounts of time were required to achieve a uniform concentration of tracer gas within each of the buildings, due to differences in air distribution systems, interior configuration, and ventilation system airflow rates among the buildings. In order to verify that a uniform tracer gas concentration had indeed been achieved, the concentration was sampled at many locations within each building. The rate of tracer gas concentration decay at each of these air sample locations was determined over a period of one to two hours, during which time the exterior and interior environmental conditions and fan operation status were monitored and recorded.

TABLE 3

Summary of Building Air Exchange Measurements

Building	Number of Measurements	Mean Air Exchange Rate	Median Air Exchange Rate
A	228	1.73	1.65
B	392	0.97	0.41
C	521	0.90	0.91
D	544	0.99	0.94
E	536	0.80	0.72
F	127	1.15	1.12
G	93	0.89	0.90
H	94	0.78	0.50
I	175	0.75	0.67
J	93	0.29	0.25
K	52	0.54	0.40
L	131	0.73	0.65
M	48	1.19	0.96
N	90	0.99	1.07
All Buildings	3122	0.94	0.89
All Buildings Except A and C	2373	0.88	0.80

These measurements employed microcomputer-based, automated tracer gas measurement systems that controlled the tracer gas injection, the air sampling, and the tracer gas concentration measurement, and recorded the tracer gas concentrations, the environmental conditions, and the fan operation status. These systems ran unattended and were capable of monitoring 10 air sampling locations, with the tracer gas concentration at each location being monitored once every 10 minutes. In buildings in which 10 air sample locations were insufficient to characterize the interior tracer gas concentration, more than one of the automated systems were employed.

RESULTS

Hundreds of tracer gas decay tests were conducted in each of these 14 buildings for a total of more than 3000 air exchange measurements. Tests were conducted in each building for at least one month during each season of the year, with some buildings tested for longer periods. No special equipment operation schedules were employed during these tests, i.e., the buildings were occupied and operated in the same manner as would have occurred had the measurement equipment not been installed. Even with the large number of measurements made in each building, the data set for each building is not necessarily representative of the building's average performance due to the dependence of air handler operation and air exchange rate on exterior weather conditions. Although the results cannot be interpreted to yield rigorous measures of the building's average or typical performance, they still may be expected to provide approximations of the building's typical air exchange rates. The more data points collected for a building, the better these data can be expected to approximate the building's average air exchange performance.

Figures 3 through 16 show air exchange rate frequency distributions for each of the buildings, and Table 3 shows each building's mean and median air exchange rate. In the figures, the vertical axis is the number of measured air exchange rates in each 0.25 ach interval of air exchange rates. The table contains the mean and median air exchange rate of each building and of all the buildings together, as well as the number of measurements made in each building.

Most of the frequency distributions can be characterized as "log normal," with a predominance of lower air exchange rates. Such a distribution is characterized by a median value that is below its mean. Those buildings with a large number of measurements clearly exhibit this trend, e.g., Figures 4 (Building B), 6 (D), and 7 (E). Buildings with a smaller number of measurements are more apt to exhibit a "scattered" distribution of air exchange rates, e.g., Figures 10 (Building H), 11 (I), and 15 (M).

The air exchange rates for some of the buildings, due to unique characteristics of their ventilation and control systems, yield distributions that are different from the log normal distribution seen in the buildings with automatically controlled VAV systems. For example, the air exchange rates measured in Building C (see Figure 5) are almost all in the range from 0.75 to 1.0 ach, with about one-third as many between 1.0 and 1.25. The data from Building C exhibit this distribution because the building has a constant-volume air-handling system with 100% outdoor air intake. The relatively small number of air exchange rates below 0.75 ach occurred during extreme weather conditions (either very hot or very cold) when the air handlers are turned off, presumably to reduce the space-conditioning load of the building. Building K, in Figure 13, is the only other building with a constant-volume

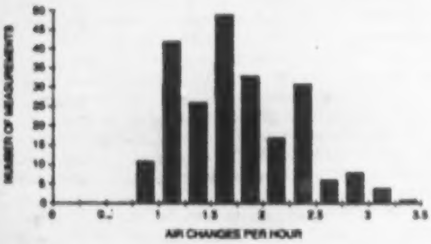

Figure 3 Frequency distribution of air exchange rates in Building A

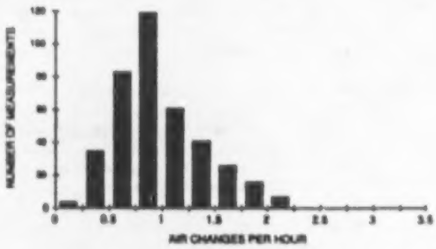

Figure 4 Frequency distribution of air exchange rates in Building B

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air-handling system and it exhibits a predominance of air exchange rates less than 0.5 ach. The data above 1.0 ach were collected under extremely windy conditions when the envelope infiltration rate of the building was very large, making the total air exchange rate much larger than the mechanical ventilation system's contribution.

About half of the buildings have mean and median air exchange rates between about 0.9 or 1.0 ach. Buildings H, J, and K have median air exchange rates of less than 0.5. Building A has much larger air exchange rates than the other buildings—a mean of 1.73 and a median of 1.65 ach. As noted above, Building C also has an unusual distribution of air exchange rates, due to its unique air-handling system. Because Buildings A and C have very different air exchange characteristics from the other 12 buildings, the data from these two buildings are neglected in some of the analyses that follow. The ventilation characteristics of the remaining 12 buildings appear to be fairly typical of modern mechanically ventilated office buildings.

Figure 17 is a frequency distribution of the measured air exchange rates in all of the buildings, and Figure 18 is the distribution without Buildings A and C. The effect of the large number of measurements in these two buildings, and their higher values relative to the other buildings, is evident in comparing these two figures. The mean air exchange rate for all of the buildings is 0.94 ach, and the median is 0.89. Neglecting the data collected in Buildings A and C, the mean air exchange rate is 0.88 ach and the median is 0.80. Because there are a different number of measurements in each building, these "all-building" distributions are biased by the data from those buildings with larger numbers of measurements. In order to avoid this bias, each building's distribution was normalized by dividing the number of measurements in each range by the total number of measurements in the building. These values were then multiplied by 100 to yield the distribution that would have existed had there been 100 measurements in each building. These distributions were then combined to yield the "unbiased" distributions in Figures 19 and 20.

The above distributions of air exchange data provide useful statistical information on the air exchange rates that occur in these particular buildings, but the question remains of how these measured values compare to the minimum ventilation levels specified for each building and to recommended levels of ventilation. The specified level of minimum outdoor air intake for each building is given in Table 2 in units of ach. The recommended minimum level of outdoor air intake in ASHRAE Standard 62 (ASHRAE 1989) is 10 L/s (20 cfm) per person. In the previous version of the standard (ASHRAE 1981) there were two levels, depending on whether smoking was permitted in the space. When smoking was permitted, the level was 10 L/s (20 cfm) per person, and when there was no smoking the minimum level of outdoor air intake was reduced to 2.5 L/s (5 cfm) per person. Other levels of interest include 5 L/s (10 cfm) and 7.5 L/s (15 cfm) per person. The latter value is the amount of ventilation required to keep the steady-state carbon dioxide concentration below 1000 ppm given the CO_2 generation rate associated with one person. The former value is employed in other ventilation guidelines.

These ventilation recommendations can be converted to ach by making assumptions about the building volume associated with one person. The ASHRAE standard recommends that one assume an occupant density of seven people

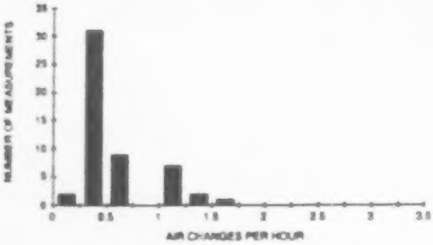

Figure 13 Frequency distribution of air exchange rates in Building K

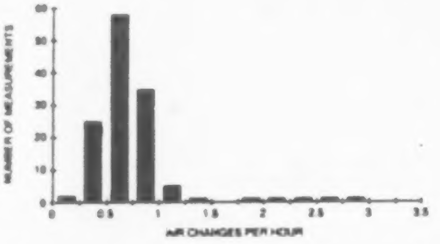

Figure 14 Frequency distribution of air exchange rates in Building L

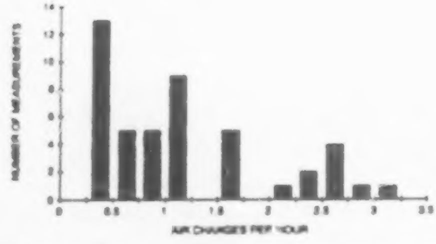

Figure 15 Frequency distribution of air exchange rates in Building M

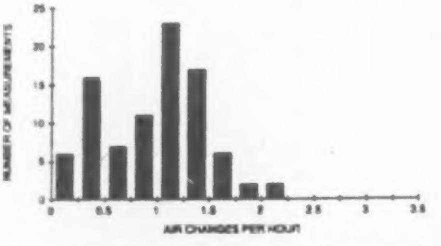

Figure 16 Frequency distribution of air exchange rates in Building N

TABLE 4

Ventilation Levels in Air Changes per Hour

Ventilation per Person	Ceiling Height of 3.5 m (11.5 ft)	Ceiling Height of 2.44 m (8 ft)
10 L/s (20 cfm)	0.72	1.03
7.5 L/s (15 cfm)	0.54	0.77
5 L/s (10 cfm)	0.36	0.52
2.5 L/s (5 cfm)	0.18	0.26

These calculated air exchange rates are based on an assumed occupant density of 7 people per 100 m² (1000 ft²).

per 100 m³ (1000 ft³), unless a more accurate value is available. Therefore, the volume associated with one person is 14.3 m² (143 ft²) multiplied by the ceiling height of the space. In most modern office buildings, there is a return air plenum above the suspended ceiling through which the interior air flows back to the air-handling system. Since this return air is generally recirculated into the supply airstream, the ceiling height employed in this volume calculation should include the height of this plenum. A typical ceiling height in this case is 3.5 m (11.5 ft).

Table 4 contains the four recommended levels of ventilation in units of ach for a typical ceiling height in an office building employing a return air plenum, and for the ceiling height in Building C, which does not have a return air plenum. The ASHRAE standard of 20 cfm per person converts to 0.72 ach in a typical office building, and 1.03 ach in Building C. These values are approximate due to the assumed values of occupant density and ceiling height.

Referring back to Table 2, in which the available ventilation system design specifications were given for the buildings, we can compare the specified levels of minimum outdoor air intake to the "standard" levels in Table 4. Buildings D and E have minimum outdoor air intake levels corresponding to 10 L/s (20 cfm) per person, while the levels in Buildings L and N correspond to 5 L/s (10 cfm). Building M is at 7.5 L/s (15 cfm) per person and Building H is somewhat less than this level.

The calculated air exchange rates in Table 4 were compared with the measured values in the 14 buildings and the results are shown in Table 5. This table shows the percentages of air exchange measurements in each of the buildings that are below 10, 7.5, 5, and 2.5 L/s (20, 15, 10, and 5 cfm), respectively. These percentages are also given for all of the buildings together, both with and without Buildings A and C. Both all-building data sets, normalized to account for the different numbers of measurements in each of the buildings, are also analyzed.

From Table 5, it can be seen that only Building J has a significant number of measured air exchange rates below 2.5 L/s (5 cfm). Several of the buildings have a significant number

TABLE 5

Comparison to Minimum Levels of Ventilation

	Percent of Air Exchange Rate Measurements Below Given Level				
Building	< 10 L/s (20 cfm)	< 7.5 L/s (15 cfm)	< 5 L/s (10 cfm)	< 2.5 L/s (5 cfm)	< Design Level*
A	0%	0%	0%	0%	**
B	27%	12%	4%	0%	**
C	82%	13%	5%	0%	100%
D	23%	11%	0%	0%	23%
E	49%	26%	8%	0%	49%
F	24%	7%	0%	0%	**
G	25%	10%	1%	0%	**
H	64%	57%	24%	1%	37%
I	59%	16%	2%	0%	**
J	98%	92%	81%	18%	100%
K	81%	65%	42%	0%	81%
L	60%	27%	5%	1%	5%
M	38%	35%	0%	0%	30%
N	30%	27%	16%	0%	16%
All Buildings	45%	20%	8%	1%	52%
Normalized***	47%	26%	13%	1%	49%
All Buildings except A and C	41%	23%	10%	1%	49%****
Normalized***	48%	33%	16%	2%	43%****

* Minimum level of outdoor air intake from ventilation system design specifications.

** Design value unavailable.

*** These percentages are based on a normalized distribution for each building in which there are 100 air exchange rate measurements in each building.

**** These percentages do not include the data collected in Building J, but do include the data collected in Building C.

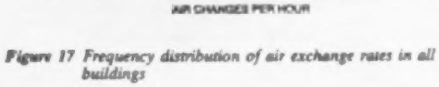

Figure 17 Frequency distribution of air exchange rates in all buildings

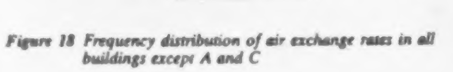

Figure 18 Frequency distribution of air exchange rates in all buildings except A and C

of measured air exchange rates below the three higher ventilation levels. Building A, with its unusually high air exchange rates, was always above 10 L/s (20 cfm) per person. More than 40% of the measured air exchange rates in all of the buildings are below the ASHRAE standard's recommendation of 10 L/s (20 cfm). Correcting for the different number of air exchange rate measurements in each of the buildings, and neglecting the data for the two buildings (A and C) with unusual air exchange characteristics, this percentage increases to almost 50%.

The last column of Table 5 shows the percent of measured air exchange rates in each building that are below the building's design level for minimum outdoor air intake. The data from Buildings C and J are always below the design level, with varying percentages in the other buildings for which a design value was available. Considering all of the data in all of the buildings, 52% of the measured air exchange rates were below their design values. Normalizing to account for the different numbers of measurements in the buildings reduces this percentage to 49%. The design specification for the minimum level of outdoor air intake in Building J is suspected of being an error, as mentioned earlier, and therefore these percentages are also given for all of the buildings except J. Therefore we see that these buildings, and presumably others, are ventilated at levels below their minimum outdoor air intake specifications for significant periods of time.

SUMMARY

The air exchange rates of mechanically ventilated office buildings include both uncontrolled air infiltration through the building envelope and intentional outdoor air intake through the ventilation system. The outdoor air intake rate is generally not constant, as the ventilation control system responds to weather and interior loads. However, the ventilation system is always supposed to supply a minimum amount of outdoor air. This minimum level of ventilation is part of the ventilation system design specifications and is generally based on recommendations in ventilation standards and guidelines.

The actual air exchange rate in a mechanically ventilated building is determined by the ventilation system design including the outdoor air intake controls, the system's operation schedules, the building envelope airtightness, and the interior configuration of the building. This air exchange is an inherently complex phenomenon, with proper performance requiring careful attention to the design, installation, operation, and maintenance of several systems and components. The actual air exchange rates in these buildings can be quite different from their design values, and tracer gas measurements are the only reliable way to determine the actual air exchange rates.

The NIST has studied the air exchange characteristics of 14 office buildings in the U.S. using the tracer gas decay technique, and these 3000 air exchange rate measurements constitute a unique data set. With only 14 buildings, it is impossible to make generalizations regarding the effects on air exchange of building age, construction style, and ventilation system type. Most of the buildings exhibit a log-normal distribution of air exchange rates with a median value below the mean. Some of the buildings have unique air exchange characteristics such as high or low air exchange rates compared with the other buildings, or relatively constant air exchange rates in buildings with constant-volume ventilation systems. The most significant difference in the buildings is in the air exchange rate under conditions of minimum outdoor air intake. This value is of interest in relation to both the building's design specifications and to recommended levels of ventilation.

The average air exchange rate for all of the buildings is about 0.9 ach. About one-half of the measured air exchange rates are below the buildings' minimum outdoor air intake design specifications. About 40% of the measured air exchange rates are below the 10 L/s (20 cfm) per person recommendation in the ASHRAE ventilation standard.

ACKNOWLEDGMENTS

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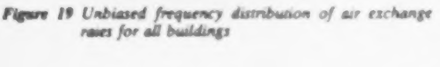

Figure 19 Unbiased frequency distribution of air exchange rates for all buildings

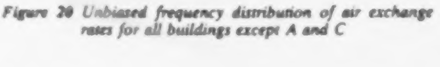

Figure 20 Unbiased frequency distribution of air exchange rates for all buildings except A and C

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DISCUSSION

Arthur E. Wheeler, Wheeler Engineering Co., Towson, MD: In calculating cfm per person from air changes per hour, how did you determine the effective building volume and number of occupants?

A. Persily, National Institute of Standards and Technology, Gaithersburg, MD: The relationship between cfm per person and air changes per hour depends on the volume assumed to be associated with each person. As discussed in the paper, I assumed an occupant density of 7 people per 1000 ft^2 and a ceiling height dependent on the buildings. If alternative assumptions are appropriate for a particular building, these calculations can easily be adjusted.

Stephen A. Roosa, ICI Americas Inc., Charlestown, IN: After having described the sample building as having high infiltration rates, can you determine or detail the relative components of infiltration and mechanical ventilation for the buildings tested?

Persily: The relative quantities of infiltration and intake in a building depend on many building-specific factors, including envelope airtightness, weather, and ventilation system zoning and operation. In one of the buildings, we have made simultaneous measurements of infiltration and intake (see Persily and Nostrand, *ASHRAE Transactions*, Vol. 93, Part 2).

Carl N. Lawson, LRW Engineers, Tampa, FL: In your study of these buildings, which type of system—VAV or CAV—seemed to function the best?

Persily: Due to the small number of buildings tested, it is impossible to make generalizations regarding ventilation system type. In fact, the type of system is probably less important than the quality of the system design, installation, operation, and maintenance.

William A. Turner, Harriman Associates, Auburn, ME: You stated that infiltration rates were significant in the study building. We have not found this to be the case in low-rise commercial buildings. Could you comment on this?

Persily: The amount of infiltration will vary significantly among buildings. Unfortunately, there is too little data to make generalizations about the effects of building type. Your results in low-rise commercial buildings could be due to reduced stack effects compared to tall buildings and/or more successful pressurization of the building interior in these buildings. Building-specific explanations require building-specific measurements.

Turner: We have found that outside air is most likely to be less than design in leaky buildings, I assume because of excess leakage at design conditions. Could you comment on this?

Persily: I find your observations interesting, though the correlation may be fortuitous rather than intentional. I find it hard to believe that building operators are making valid assessments of envelope leakage. I also find it difficult to give them credit for such conscientious efforts to control outdoor air intake rates.

Richard Gorman, NIOSH, Cincinnati, OH: How were the buildings selected for study?

Persily: Each of the buildings was studied for a different reason, ranging from poor thermal performance to indoor air quality complaints. Some were tested due to unique design features. Only two of the buildings were characterized by a large number of indoor air quality complaints.

James E. Woods, Honeywell Indoor Air Quality, Golden Valley, MN: Congratulations on an excellent presentation on data that are important to improving our knowledge of objective measures of ventilation. Would you please comment on the influence of multiple systems within a building and of multiple zones within a system (i.e., on ventilation efficiency)?

Persily: Although the tracer gas decay measurements are based on an assumption of the building being a single, well-mixed zone, there are certainly cases in which the supply air distribution is not uniform within a building. This nonuniform distribution is sometimes due to the existence of multiple air handlers, and can also exist when there is only a single air handler. The result is that certain areas within a building (zones, floors, sections of a floor, or rooms) receive proportionally less supply air (and outdoor air) relative to other areas of the building. These variations in supply air distribution can impact thermal comfort and air quality, and new measurement techniques are being developed and applied to quantify these variations.

STATE OF CALIFORNIA—THE RESOURCES AGENCY PETE WILSON, Governor

CALIFORNIA ENERGY COMMISSION
CHARLES R. IMBRECHT
Chairman

May 21, 1991

The Honorable James Scheuer
Chair, House Science Subcommittee
on Environment
U.S. House of Representatives
Washington, D.C. 20515

Dear Mr. Scheuer:

H.R. 1066 addresses the need for more information on the solutions to indoor air quality problems. The California Energy Commission would like to express its concerns regarding the interaction between indoor air quality and energy use in buildings. Without careful thought, improving indoor environmental quality could come at the expense of increasing energy use and air pollution. But better understanding can allow both issues to be resolved satisfactorily.

The Commission sets building efficiency standards that attempt to balance the needs for energy conservation and occupant health and comfort. Earlier this year the Commission revised its nonresidential building standards and received a great deal of comment regarding the need for ventilation to protect public health. The Commission considered and rejected a proposal that we adopt the ASHRAE standard 62-1989 that attempts to solve the indoor air quality problem by requiring very high ventilation rates, which would result in dramatically higher energy use in buildings. Our analysis shows that in some climate zones energy use for heating, ventilating, and air conditioning would more than double under the ASHRAE standard compared to ventilation rates the Commission adopted. While the Commission did increase required ventilation rates in our building standards, the ASHRAE standard was rejected after a broad range of participants, including a national environmental organization along with ventilation engineers, testified that ventilation was not the most effective, or the only, way of addressing health issues associated with indoor air quality.

The problem is that there is not enough information on health-based chemical exposures and emission rates from different materials to set appropriate ventilation rates. More importantly, not enough has been done to reduce the *emission* of dangerous chemicals from indoor building materials and consumer products. Using ventilation alone to solve the indoor air quality problem is like early efforts to improve air quality by requiring tall stacks on power plants to dilute the emissions, when the effective solution was to reduce the emissions themselves. Similarly, the solution to indoor air quality problems must be based on a mix of ventilation and source reduction, and to do that requires information on exposures and emissions that is currently available only for a limited number of indoor pollutants and sources.

The Commission supports the intent of H.R. 1066 to increase efforts to reduce indoor air pollution, and to require that EPA set testing and labelling requirements for emissions from various

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building materials. Testing and labelling is an essential first step to reduce both the *source* of emissions, as well as to set appropriate ventilation requirements for indoor pollutants. However, the Commission opposes setting a ventilation standard in law until additional research has been done on techniques to balance the needs for public health, comfort, and energy conservation. Therefore we recommend that Section 15 be deleted from H.R. 1066.

Sincerely,

CHARLES R. IMBRECHT
Chairman

Comments of the California Energy Commission

To the House Science Subcommittee on Environment

Regarding Indoor Air Quality

May 22, 1991

The California Energy Commission would like to contribute to a solution to the indoor air quality problem that will assure healthy indoor environments while also meeting energy conservation goals. We believe the approach used in our nonresidential building efficiency standards is superior to the ASHRAE standard, as discussed below.

Attached is the ventilation section from the Commission's nonresidential building efficiency standards that were adopted on March 8, 1991 and will be effective July 1, 1992. The ventilation standard was the result of extensive discussions with the California Air Resources Board, the Department of Health Services, professional mechanical engineers, and interested pubic participants such as the Natural Resources Defense Council and the Environmental Health Network (representing chemically sensitive persons).

At the May 9 Health and Environment Subcommittee hearing several witnesses recommended amending H.R. 1066 to include the ASHRAE 62-1989 ventilation standard. While many of our requirements are similar to ASHRAE 62-1989, there are important differences which are briefly highlighted below. We believe that our new standard is superior to ASHRAE 62-1989 not only because our standard will result in significantly lower energy use, but also because it is more practical and enforceable as a standard, and hence more likely to improve indoor air quality.

The new California standard has the following features:

- Recognizing the need for healthy indoor air, the new standard increased the minimum outdoor air rate from 5 cubic feet per minute/person in the existing standard to 15 CFM/person. Since low occupancy environments can have poor indoor air quality, we also set a minimum outdoor air rate of .15 CFM/square foot. The effect of this is that for an office with 7 persons/thousand square feet the ASHRAE 62-1989 office rate of 20 CFM/person is the minimum rate, but that when occupant density exceeds 10 persons/thousand square feet, 15 CFM/person becomes the minimum rate. The ASHRAE standard requires higher ventilation rates in high occupany spaces such as conference rooms, restaurants, and assembly rooms.

- In contrast to the ASHRAE 62-1989 procedure, our standard allows outdoor air to be "transferred" to rooms like conference rooms (as opposed to provided directly) if the outdoor air requirement for the conference room and the adjacent space together is met. In order to meet the ASHRAE 62-1989 requirement for conference rooms, either a separate ventilation system must be built for conference rooms, or the whole building must be ventilated at 100 percent outside air, both of which are unreasonable outcomes.

This provision is probably the most significant difference in terms of energy use between the California and ASHRAE standards.

- Where sources of unusual contaminants are present, ventilation rates are increased depending on occupancy and source dilution needs. ASHRAE has similar requirements, but we reached different conclusions than ASHRAE regarding some occupancy types (Table 2-53F).

- Ventilation rates can be met through natural ventilation provided the space is within 20 feet of an operable wall or roof opening. ASHRAE allows natural ventilation if it can be demonstrated to provide ventilation rates equivalent to mechanical systems. However, since no test methods or conditions are specified for this demonstration, and since it is clear that under certain conditions (e.g., when windows are closed) natural ventilation will not be equivalent, natural ventilation is effectively precluded.

- We added operation requirements that specify that the minimum outdoor air rate must be supplied at all times the space is occupied, and must be ventilated at least one hour prior to occupancy. While this is difficult to enforce, we believe this will be used as a guideline for establishing automatic control strategies. This is a more stringent and practical requirement than in the ASHRAE 62-1989 standard.

- We allow carbon dioxide sensors to be used to reduce the rate of outside air to .15 CFM/SF provided that the level of carbon dioxide does not exceed 800 parts per million while the space is occupied. This is essential to reduce energy use in intermittently occupied spaces like schools, hotel meeting rooms, theaters, and other assembly spaces. ASHRAE allows a maximum carbon dioxide concentration of 1,000 PPM, and does not specifically allow ventilation rates to be reduced below peak levels.

- We allow outdoor air to be provided to zonal heating and cooling units through the plenum, but we require that the outdoor air be ducted to the vicinity of the unit. ASHRAE does not address this type of system, which is common throughout the country.

- Finally, to encourage appropriate building commissioning, we require documentation to verify that the outdoor air requirements are being met. The documentation will also provide information needed to meet the requirements of the California Safety Act, which requires that an employer must provide information to an employee about the operation and maintenance of the equipment when requested.

Attachment: CEC ventilation standard for nonresidential buildings

Section 2-5321. Requirements for Ventilation.

(a) General Requirements.

1. All enclosed spaces in a building that are normally used by humans shall be ventilated in accordance with the requirements of this section.

NOTE: In addition to meeting the requirements of this section, for those occupancies where unusual contaminants are present or anticipated (such as commercial dry cleaners, coin-operated dry cleaners, bars and cocktail lounges, auto repair workshops, smoking lounges, barber shops, beauty shops), it is recommended to use local exhaust ventilation and enclosure to capture the contaminants and discharge them directly outdoors.

2. The outdoor air ventilation rate and air distribution assumptions made in the design of the ventilating system shall be clearly identified on the plans required by Section 1403 of Title 20.

(b) Design Requirements for Minimum Quantities of Outdoor Air. Every space in a building shall be designed to have outdoor air ventilation according to 1. or 2.:

1. Natural Ventilation. Natural ventilation may be provided for spaces that:

   A. Are within 20 feet of an operable wall or roof opening through which outdoor air flows, which has an openable area more than 5% of the conditioned floor area of the space, and which is readily accessible to occupants of the space at all times when the space is occupied; and

   B. Have a direct outdoor air flow from the operable wall or roof opening, unobstructed by walls or doors.

2. Mechanical Ventilation. Each space that is not naturally ventilated under 1. shall be ventilated with a mechanical system capable of providing an outdoor air rate no less than the larger of:

A. The conditioned floor area of the space, times the applicable ventilation rate from Table 2-53F; or

B. 15 cfm per person, times the expected number of occupants (which, for spaces without fixed seating, shall be no less than one-half the occupant density assumed for exiting purposes in Chapter 33 of the UBC, times the area of the space).

EXCEPTION to Section 2-5321(b)2.: Transfer Air. The rate of outdoor air required by Section 2-5321(b)2. may be provided with air transferred from other ventilated spaces, if:

I. None of the spaces from which air is transferred have any unusual sources of indoor air contaminants; and

II. Enough outdoor air is supplied to all spaces combined to meet the requirements of Section 2-5321(b)2. for each space individually.

TABLE 2-53F
MINIMUM VENTILATION RATES

Type of Use Area	Cfm per Square Foot Of Conditioned Floor
Auto Repair Workshops	1.50
Barber Shops	0.40
Bars, Cocktail Lounges, and Casinos	1.50
Beauty Shops	0.40
Coin-Operated Dry Cleaning	0.30
Commercial Dry Cleaning	0.45
High-Rise Residential	Per UBC Section 1205
Hotel Guest Rooms (less than 500 sq. ft.)	30 CFM/Guest Room
Hotel Guest Rooms (500 sq. ft. or greater)	0.15
Retail Stores	0.20
Smoking Lounges	1.50
All Others	0.15

(c) Operation and Control Requirements for Minimum Quantities of Outdoor Air.

1. Times of Occupancy. The minimum rate of outdoor air required by Section 2-5321(b)2. shall be supplied to each space at all times when the space is usually occupied.

EXCEPTION No. 1 to Section 2-5321(c)1.: Demand Control Ventilation. The rate of outdoor air provided to an intermittently occupied space may be reduced to 0.15 cfm per square foot of conditioned floor area, if the ventilation system serving the space is controlled by a demand control ventilation device approved by the Commission and:

I. If the device is a CO_2 sensor, it limits the CO_2 level to no more than 800 ppm while the space is occupied; and

II. The sensor for the device is located (1) in the space; or (2) in a return air stream from the space with no less than one sensor for every 25,000 square feet of habitable space, or no more space than is recommended by the manufacturer, whichever is less.

EXCEPTION No. 2 to Section 2-5321(c)1.: Temporary Reduction. The rate of outdoor air provided to a space may be reduced below the level required by Section 2-5321(b)2. for up to 5 minutes each hour if the average rate each hour is the required rate.

2. Pre-Occupancy. The minimum rate of outdoor air required by Section 2-5321(b)2., or three complete air changes, whichever is less, shall be supplied to the entire building during the one-hour period immediately before the building is normally occupied.

(d) Ducting for Zonal Heating and Cooling Units. Where a return plenum is used to distribute outdoor air to a zonal heating or cooling unit which then supplies the air to a space in order to meet the requirements of Section 2-5321(b)2., the outdoor air shall be ducted to discharge either:

1. Within 5 feet of the unit; or

2. Within 15 feet of the unit, substantially toward the unit, and at a velocity not less than 500 feet per minute.

(e) Design, and Control Requirements for Quantities of Outdoor Air. All mechanical ventilation and space conditioning systems shall be designed with and have installed duct work, dampers, and controls to allow outside air rates to be operated at the larger of (1) the minimum levels specified in Section 2-5321(b)2.; or (2) the rate required for make-up of exhaust systems that are required for a process, for control of odors, or for the removal of contaminants within the space.

(f) Completion and Balancing. Before an occupancy permit is granted for a new building or space, or a new space conditioning or ventilating system serving a building or space is operated for normal use, all ventilation systems shall be documented in accordance with Title 8, Section 5142(b) of the California Safety Code (1987) to be providing the minimum ventilation rate specified in Section 2-5321(b)2., as determined using one of the following procedures:

1. Balancing. The system shall be balanced in accordance with the National Environmental Balancing Bureau (NEBB) Procedural Standards (1983); or 2. Associated Air Balance Council (AABC) National Standards (1986); or

2. Outside Air Certification. The system shall provide the minimum outside air as shown on the mechanical drawings, and shall be measured by the installing licensed C-20 mechanical contractor and certified by (1) the design mechanical engineer, (2) the installing licensed C-20 mechanical contractor, or (3) the person with overall responsibility for the design of the ventilation system; or

3. Outside Air Measurement. The system shall be equipped with a calibrated local or remote device capable of measuring the quantity of outside air on a continuous basis and displaying that quantity on a readily accessible display device; or

4. Another method approved by the Commission.

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May 7, 1991

The Honorable James H. Scheuer
Chairman
Subcommittee on the Environment
Committee on Science Space and Technology
U.S. House of Representatives
Suite 2320 Rayburn House Office Building
Washington, D.C. 20515

Dear Chairman Scheuer:

The National Institute of Building Sciences appreciates the opportunity to comment on H.R. 1066, The Indoor Air Quality Act of 1991. Although the Subcommittee's May 1, 1991, letter specifically seeks the Institute's testimony on the provisions addressing ventilation standards for public and commercial buildings, and indicates the May 9, 1991 hearing will focus on Sections 15, 16, and 17 of the bill, the Institute's comments address other aspects of the bill to place our comments in context. The following comments relate to the identified sections of the bill:

Findings

Section 2. (7). Radon deaths cited (8,000 to 40,000 per year) differ from the latest EPA estimate of 16,000 radon induced lung cancer deaths per year. This illustrates the lack of clear data about the number of deaths caused by radon and by other indoor air contaminants.

Federal Building Evaluation and Remediation Program

Section 9. The Federal Building Evaluation and Remediation Program applies to "buildings greater than 10,000 square feet in [floor] area that are owned, leased, or operated by the Federal Government." Section 9 (a) (1) requires the development of a compilation of the names of all federal buildings with a listing of the number of employees and a ratio of total work space to number of employees.

GSA operates buildings comprising approximately 236,000,000 square feet which house more than one million employees. With a few exceptions, these do not include buildings operated by the Army, Navy, Air Force, USDA, VA, DOE, Postal Service, State Department, and other agencies which provide space to another two million federal employees, plus military personnel. Although GSA is responsible for approximately 1,500 federally owned buildings, it enters into leases for space in approximately 10,000 other locations (buildings). Although most of these are for more than 10,000 square feet each in floor area, numerous leases for smaller quantities of space are usually handled by the user agency rather than GSA.

It is important to note that most GSA and user agency leases are not for an entire building, rather they are to lease a small portion of a building which is also occupied by other private or public tenants.

The record keeping directed by this provision constitutes a mammoth and costly task. If the intent is to determine the typical indoor air environment in federal buildings, a representative sample may provide a more cost effective approach with which to yield the intended benefit.

Indoor Air Quality Research

Section 5. (h), Lead Exposure In Children. Many believe we now know more about the source, extent, and effect of lead exposure than for most other IAQ contaminants. We are able better to develop and implement solutions, and assess their effectiveness than for most other contaminants. Although it is always useful to know more about the sources of lead and the relative contributions of each, greater emphasis is needed on the development and prompt implementation of cost effective mitigation actions for this contaminant.

Council On Indoor Air Quality

Section 12 (a) and (d). No provisions are included in the bill for explicit state government and private sector interaction with the CIAQ. There are numerous organizations which operate in the public interest whose advice should be sought such as ASHRAE and other standards writing organizations, the American Institute of Architects, engineering organizations, and model building code organizations. NIBS, in accordance with its Congressional charter provides a forum within which the federal government, states, and the private sector can cooperatively address such issues. This would augment the Indoor Air Panel of the Science Advisory Board by providing for practical coordination from those who will be called upon to implement this law.

Indoor Air Quality Clearing House

Section 13. No single clearinghouse can reach all of the sectors, organizations, and individuals needed to assure the complete collection, assessment and the dissemination of IAQ information. By using the existing network of consumer interest and building community organizations, information can be distributed, updated and appropriately used by designers, code officials, builders, contractors, labor, testing agencies, product manufacturers, building and home owners, building managers and operators, and occupants.

Further, methods to disseminate (and update) useable information (requirements, guidelines, standards, etc.) such as NIBS' Construction Criteria Base (see attached information) are already available. These sources can become nodes on an effective and efficient IAQ information network. Thus it is recommended that the authorization be modified to provide for multiple contracts with more than one nonprofit organization.

Ventilation standards for Public or Commercial Buildings

Section 15. The ventilation standards section adopts two ventilation rates, a 100% exhaust requirement for smoking areas, and a duct leakage provision from the numerous provisions of the recently approved National Standard, ASHRAE Standard 62-1989, Ventilation for Acceptable Indoor Air Quality. However, the standard contains numerous other technical provisions requisite to providing acceptable indoor air quality which are not enumerated in the bill. This affords nearly endless possibilities for conflict because the technical requirements in the law are so abbreviated. If the intent is to fill in the blanks by regulation, it would be far simpler to simply adopt by reference the ASHRAE standard.

However, if part of the provisions of a complex technical standard are set through either federal legislation or regulation, improving and updating these technical provisions will depend on the Congress returning promptly to the issue, an unlikely occurrence given its broad responsibilities, or on the agencies' budgets, personnel, and authority to readdress the issue in a timely manner. Thus, even though better methods are devised to provide improved indoor air quality, their use will be prevented because its technical provisions are "cast in concrete."

The nation's voluntary standards and model code development organizations recognize this need and have established procedures to provide for a more timely response. For example, when the 1981 edition of ASHRAE Standard 62 was approved, ASHRAE immediately set to work to update it. Likewise, a new committee has already been formed to update the recently issued 1989 standard. Similarly, the model code organizations update their building codes annually and republish them every three years. One of the code organizations' purposes in this annual process is to consider and use updated standard like the ASHRAE indoor air standard. This "known" schedule of model code updating is typically followed by states and local building departments in their code update process by adopting these model codes into law.

A preferable method for helping to insure adequate air quality through the most cost effective methods would be to encourage the adoption of the ASHRAE standard by local and state building codes through cooperative programs with the nations' three model building codes. One of these model codes, the Standard Code System, produced by the Southern Building Code Congress, International, headquartered in Birmingham, Alabama, has already adopted by reference the 1989 edition of ASHRAE Standard 62 in its entirety in its model building and mechanical codes. By adoption through the model code process, subsequent versions of the ASHRAE standard can be automatically considered for adoption; thus, providing a mechanism for allowing the safe use of new methods and equipment to provide adequate indoor air quality.

Further, a mechanism for the coordination of indoor air quality needs, is, along with other health and safety demands addressed by building codes, provided for through the technical code committees operated by the model code organizations. In this way, heating, cooling, moisture control, humidity, fresh air, air circulation, fire dampers, noise, odor, and other related issues can be coordinated, rather than left to chance.

In this period of federal budget cutbacks, it is unlikely that OSHA will receive the funding necessary to hire, train, and maintain personnel to provide the plan review and inspection functions necessary to efficiently enforce this proposed provision. More importantly, were this unlikely funding to occur, it would duplicate currently available capability at the state and local levels, thus, duplicating costs borne by taxpayers.

The proposed bill presents many potential procedural problems as well. For example, model codes and local governments may delete ventilation provisions from their current and future building codes in order to avoid conflict with this preemptive law and the potential liability arising from the differences between local codes and a federal law.

There is a precedent for these concerns. The safety glazing rule promulgated by Consumer Product Safety Commission (CPSC) resulted in several years of chaos when safety glazing provisions were deleted from building codes to avoid duplication and conflict with the CPSC rule. By not using the state and local building code process, the CPSC had no effective way to insure its rule was enforced. Eventually the rule was withdrawn in favor of using the existing building regulatory process.

Even though there are few things harder to put up with than the annoyance of a good example, the lessons learned by the safety glazing issue should be used to help us to avoid similar problems with the proposed indoor air quality bill. The nation's state and local code officials and the thousands of code departments in which they work constitute invaluable resources which are currently addressing indoor air quality and scores of other health and safety issues in buildings. But, they must be employed in a manner consistent with regulating other building related health, safety, and general welfare issues.

The nation's voluntary standards process is relied upon to develop test methods and to set standards which govern the quality of building products, materials, equipment, and systems. These standards are universally used to achieve performance objectives in procurement through project specifications, and to meet health, safety, and general welfare objectives through building codes. Under the Constitution, regulation of construction is a responsibility of the states. Section 15 (f) and

Section 16 of H.R. 1066 propose to provide information about and require labels on products that pose a significant adverse indoor air human health threat. This may be needed for some products--cleaning solvents and office equipment--not regulated by other programs, but it would duplicate long standing successful programs used in building and home construction. Rather than duplicating existing systems, federal agencies should support and be more active in the voluntary standards process as encouraged by OMB Circular A-119. Thus, the bill's worthy objectives can be best achieved by supporting the efforts of voluntary consensus standards writing organizations and fostering their use through cooperative programs with the three model code organizations. Both of these actions are allowed and encouraged by federal agencies.

Clearly, the nation's building design professionals, constructors, code officials, and building operators need to improve their capabilities through research, education, training, management, and experience in order to do a better job to assure acceptable indoor air quality. In the complex process of building design, regulation, construction, and operation, there are few issues for which this is not the case. In virtually every sector of our complex economy--medicine, transportation, air travel, food, government--we recognize objectives before we are able to achieve them. Improving the existing building regulatory system is seen as the best and only viable method to achieve this objective.

The law as written provides explicit direction and assigns immense responsibilities to the designated agencies. Given the likely event that only a small fraction of the $267.5 million proposed to be authorized will actually be appropriated, the agencies would have little chance of implementing the law in a workable manner, yet its provisions would be the "law of the land." By passing a bill more oriented to research and proactively fostering better interaction with the states and private sector organizations to develop and implement performance oriented criteria and workable enforcement through the existing mechanisms which are more consistent with the Constitution and OMB Circular A-119, the objectives of the bill can be achieved with significantly less conflict and at dramatically less cost.

Mr. Chairman, we appreciate the opportunity to offer the Institute's comments and look forward to responding to any questions you may have as this legislation is addressed by the Subcommittee.

Sincerely,

David A. Harris, AIA
President

Enclosure

TESTIMONY OF THE
AMERICAN INDUSTRIAL HYGIENE ASSOCIATION
FOR H.R. 1066
"THE INDOOR AIR QUALITY ACT OF 1991"
FOR THE SUBCOMMITTEE ON ENVIRONMENT OF
THE U.S. HOUSE OF REPRESENTATIVES COMMITTEE OF SPACE, SCIENCE & TECHNOLOGY

The American Industrial Hygiene Association (AIHA) would like to thank the members of the United States House of Representatives Space, Science & Technology Committee for the opportunity to comment on H.R. 1066 "The Indoor Air Quality Act of 1991."

The American Industrial Hygiene Association is the world's largest occupational and environmental health association. The American Industrial Hygiene Association's 9,500 plus members worldwide from labor, academia, consulting, industry, and government are dedicated to protecting the health, safety and well-being of workers and the community. Industrial Hygienists, Physicians, engineers, chemists, safety professionals, and a myriad of other management and technical professions comprise our membership giving an overview of Indoor Air Quality (IAQ) from a politically broad yet technically focused perspective. A recent presentation by members of the AIHA Indoor Environmental Quality committee to the Consumer Federation of America presents a good overview of the long historical relationship of the profession with Indoor Air Quality and recent activities undertaken by the profession to improve it. (Attachment #1).

The American Industrial Hygiene Association has previously worked with this Committee in the 101st Congress in finalizing H.R. 5155 "The Indoor Air Quality Act of 1990." We were pleased to see that our suggestions were incorporated into last year's version. We believe consultation with the private sector on technical and policy issues will expedite and strengthen the development of the infrastructure in H.R. 1066 to reach the goals outlined for Indoor Air Quality.

The crux of AIHA's testimony today on H.R. 1066 addresses the implications of three technical provisions added to the 1991 version of the Indoor Air Quality Act. The three new additions are product labelling, mandatory ventilation standards, and possible expansion of work place indoor air quality regulations.

Product Labelling

H.R. 1066 contains language which would require labelling of products warning of potential contaminant effects and would prohibit importation of unlabelled products. We believe it is Congress' intent that this requirement would warn potential consumers and thus prevent improper usage of materials. Secondly, this labelling would possibly act as an incentive to producers to manufacture building materials that are contaminant free and thus not require a label. AIHA supports Congress' intentions but has reservations about the effectiveness of the means proposed in H.R. 1066 to achieve those intentions.

AIHA has concerns that the labels may not fairly reflect true contaminant concentrations due to variability in storage time after manufacture, variances in plant manufacturing, and time variances between storage and actual application to a living space. All these factors will cause a reduction in residual IAQ contaminants over time.

Secondly, even a building material with a low level of IAQ contaminants could pose a problem depending on the size of the room, volume of material used, ventilation rates in the occupied space, temperature changes which would give rise to off-gassing of contaminants and other factors.

Another confounding factor is determining levels of contaminant materials which would be considered "safe" versus levels which would require a label. Would odor nuisance, irritant level or carcinogenicity be the deciding factor? What would be a "fair" scenario considering all the above mentioned variables and could such a scenario be developed to make a label effective? This issue is complex and unlikely to be properly addressed by a single value.

Instead of mandatory labelling, a suggestion may be to insert or substitute language into H.R. 1066 which would encourage private sector/government research and cooperation to develop low level contaminant products. Recent successful agreements between EPA and carpet manufacturers is a good example to follow.

Mandatory Ventilation Standards

H.R. 1066 also contains language which would make mandatory the compliance of new buildings with mandatory ventilation standards. ASHRAE Standard 62-1989 is currently used by Industrial Hygienists, when possible and applicable, for Indoor Air Quality improvement. (Attachment 2) It is part of the multifactorial approach used by Industrial Hygienists and has tremendous technical merits when applied properly.

However, ventilation alone as a causative factor according to a NIOSH review of 500 Indoor Air Quality investigations was accountable for 50-62% of the IAQ problems. Unknown factors (possibly not building related), chemical contaminants from sources within and without the building and microbiological factors accounted for the remainder[1]. Building occupant activity and safely controlling that activity through the usage of prudent work practices to minimize source emissions (substitution, isolation, local exhaust when needed to suit activity) play as important a role as ventilation and in some cases more so for good air quality.

A question of fairness and potential legal quagmire could develop if a mandatory ventilation provision for new buildings is required which ignores the status of old buildings. An across the board mandatory ventilation standard not based on chemical source potential or need could be costly and unnecessary.

Ventilation and ventilation standards should be recommended not mandatory and allow for flexibility. Industrial Hygienists and other occupational/environmental professionals encounter many situations where humidity, temperature, air exchange for comfort cannot be controlled to ventilation specifications (but can and must meet OSHA/NIOSH requirements) but no ill health affect occurs or is expected. A mandated air exchange rate for all buildings lacks the flexibility to allow science and professional judgment to be effectively used to address the variety of problems (substances used, work practices, natural ventilation of building, etc.) that make each IAQ problem different. Technically, it is impossible to meet elements of mandatory ventilation standard in many work place situations for many Americans. Ventilation will prove a feasible remedy in some situations but not universally. A recommendation to use ASHRAE 62-1989 as opposed to a mandated ventilation requirement encourages better building design without a double standard of environmental working conditions being endorsed which would be technically impossible achieve in many circumstances.

A suggested change in H.R.1066 may be an interagency study of possible or alternatives to mandatory ventilation. Such a study could be charged to find flexible designs as opposed to ventilation guidelines alone which would give architects/engineers/industrial hygienists a variety of options to use to produce high quality IAQ work places and buildings. A task force of experts from the appropriate Federal agencies and the private sector could report to Congress with alternative recommendations.

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[1] T. A. Seitz, NIOSH Indoor Air Quality Investigation: 1971-1988. In The Practitioners Approach To Indoor Air Quality Investigations. Proceedings of the Indoor Air Quality International Symposium, American Industrial Hygiene Association, Akron, OH 1990, pg. 163-171.

Work Place IAQ Standards

H.R.1066 also contains language for work place IAQ standards. AIHA is in support of a feasibility study by OSHA or NIOSH to look into this area. Widespread mandatory changes in IAQ work place levels are felt by AIHA to be premature based on our current scientific knowledge, but we endorse the research provisions in H. R. 1066 to expand the base of knowledge.

AIHA strongly believes that a consensus voice needs to speak to the United States citizenry concerning acceptable exposure levels of contaminants of all kinds in all situations. This does not mean a single Agency be solely responsible for the issue, but rather that all involved Agencies cooperate and reach consensus regarding acceptable exposure levels. If consensus is not reached in this area, government authorities could prompt the development of "blue collar" vs "white collar" standards which is totally unacceptable. It is unacceptable because the industrial hygienist and other occupational/environmental health professionals are responsible for maintaining healthy work places for all workers including office and commercial building workers. A consensus decision must be made by Government authorities using the best available information considering the health and well-being of all building occupants before new standards are set.

In this regard, the private sector, including AIHA which maintains voluntary standard setting committees such as the Workplace Environmental Exposure Level committee, and other associations such as the American Conference of Governmental Industrial Hygienists Threshold Limit Value committee, should be consulted. Considerable diversity of scientific opinion exists between toxicologists, epidemeologists, occupational physicians and other scientists within and without government agencies about the health effects issues surrounding indoor air contaminants. The research provisions with H.R. 1066 are clearly needed.

Because of this diversity of scientific opinion, the Committee may want to consider a multi-disciplinary approach to help solve IAQ problems. Currently some AIHA members use a "guideline approach" for IAQ problem solving that is multi-disciplinary and solution oriented. (Attachment 2) Using a general classification system of chemical groups and certain specific chemicals that could be agreed upon by Industrial, EPA, OSHA, NIOSH and other affected groups could save millions of dollars in research which ultimately may not produce what is desired in the end, a precise substance specific standard for every IAQ contaminant. Many IAQ professionals believe this approach is more effective and offers the best solution to IAQ problems.

In summary AIHA suggests recommendation versus regulation be used in H.R.1066. The difficulty in producing relevant toxicological and epidemiological data could be used to focus research energy where it is needed most, to which recommended, but not mandated, guidelines for IAQ are exercised until science catches up to policy.

I want to thank the committee for allowing AIHA to comment and if specific questions concerning statements made arise before the May 9, 1991, hearing date, please relay them to AIHA so that supporting information can be satisfactorily supplied. AIHA supports H.R. 1066 with the exception of the concerns voiced here.

In closing, AIHA wishes to help bring the best science to bear on this problem and look forward to assisting Congress in its efforts to address the quality of air in buildings.

Prepared by

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MEMORANDUM

TO: Regina M. Gorman, Ph.D.
Science Consultant

FROM: Rosalind C. Anderson, Ph.D. RCA
President

DATE: May 21, 1991

SUBJ: Comments on Section 16 of H.R. 1066. To authorize a national program to reduce the threat to human health posed by exposure to contaminants in the air indoors.

INTRODUCTION

The intent of this bill is commendable. It reflects the growing concern about the effect on humans of the indoor environment. The subject traditionally has escaped notice in part because the symptoms which are reported are easily discounted as trivial or as signs of malingering. Serious attention to the indoors is long over due.

These comments will focus only on Section 16.

Section 16, Contaminant Emissions Product Labeling

The wording of 16(a)(2) "a significant adverse health threat" is an invitation to endless verbiage as to what constitutes "significant". The inclusion of that term appears to be directly contrary to the purpose of the bill. The symptoms associated with compromised indoor air quality (burning sensations of the eyes, nose, throat, fatigue, difficulty breathing, mucus membrane irritation) include many which are traditionally considered to be significant only by the affected individual. From the observer's perspective this group of symptoms has been classed as trivial because of being non specific, non objective, non life threatening. The data which show economic cost of lost productivity resulting from IAQ problems may be the strongest available indication of the significance of these adverse health effects.

Society through this bill may be ready to wrestle with some adverse health effects which may not class as significant but which are none-the-less important.

To make this paragraph more consistent with the apparent purpose of the bill it would be appropriate to remove the word "significant". This wording is repeated throughout the section and would need to be made consistent.

In section 16(a)(2), there are two problems, the burden of proof and the list of products to be studied. The burden of understanding the product mix in the indoor environment is awarded to the government (EPA and CPSC). The paragraph indicates that within two years of the enactment of the law these agencies will investigate products so extensively that it is possible to prepare a list of products which are harmful to health. The cost of such an investigation during the time allowed is not within the imagination of mankind. The present understanding of the effects of low levels of toxic substances is so limited that the project could not be accomplished by any single entity, including the U.S. Government in that time.

Two changes might be useful: one, to reverse the burden of proof and two, to collect some preliminary data which would serve as the basis for decisions as to which products would be covered. Generic product types could be investigated by manufacturers or groups of manufacturers (trade associations). On the basis of preliminary data, the final list of covered products could be determined or perhaps on the basis of that preliminary data individual products which meet some criterion could be excused from the regulatory follow up. This would result in a better basis for the selection of products for action than the list, (lines 9 through 15, page 56), which is not more than an assemblage of currently popular buzz words.

Although the products enumerated are defined as a minimal list, these would constitute the high priority products even if other items were to be added. The list provided has a heavy emphasis on manufactured wood products and combustion sources. To some degree these are products which have gained attention because of being constituents of residential kitchen. If House Bill 1066 is to provide protection for the occupants of large office buildings in which air quality may be of concern, the kitchen list is too specialized. Data indicate that a large number of other products are potentially contributing to indoor air problems. Examples are office supplies, office machines, thermal and acoustic insulation, wallcoverings and fabrics. Even wire and cable products which run inside air supply ducts are contributing to indoor air quality.

Labeling regulations, 16(b)(1). This section elects a regulatory approach which is simple on paper but may perhaps fail in its objective. Product labeling provides information relevant to the decision making of the buyer and hopefully information for reference if the product performance is questioned at a later time. In this bill the label device protects the wrong party.

Labeling is only visible to the purchaser, who is probably not concerned with the health status of the unknown occupant. The purchaser continues to buy by price and the occupant to assume the consequences. In addition, labels are lost forever when the product is painted or enclosed by layers of building structure. To provide only point of purchase labels avoids the issue of occupant health except for the do-it-yourself home repair jobs and the litigation chain. Some type of product ID numbering and public access data registry might be useful on a longer term basis.

Although paragraph 16(a)(1) indicates that methods will be developed for evaluation of emissions, the assumption is made for paragraph 16(b)(1) lines 24 and 25 that emission rate is the critical parameter. This value is measured by chemical analysis and indicates the amount of chemical being released. Emission rate analysis may include the identities of the chemicals released if desired.

The chemical techniques for such measurements are well developed, however, they do not address the problem which is to be corrected. In sick buildings the concern is not with the identities or amounts of chemicals in the air but only with that portion having adverse biological activity. The need is a toxic potency measure not its surrogate, the chemical quantity measure. Many chemicals in the air have no biological consequences, other chemicals are very potent. To measure and report emission rate and to imply that a low emission rate is adequate proof of goodness leads to false conclusions. Because the chemical information cannot be interpreted in terms of health effects, labeling products with emission rate data would not support the goal of the bill.

The methods of toxicology are designed to measure negative biological impact. At least one appropriate method is available (example ASTM E 981) and has been shown to distinguish between offgassing which is irrelevant and that which is irritating. Equal biological potency has been noted from two products, offgassing from one was measured at 6000 ppm the other 1 ppm. We cannot learn this from emission rate data.

The useful paradigm might be that products which meet some criteria related to the irritant potency of offgassing would be excused from the labeling requirement. Products which did not meet the desired level would then be labeled

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RICHARD P. KUCHNICKI
PRESIDENT

May 17, 1991

Subcommittee on Environment
Science, Space and Technology Committee
House Annex 2, Room 388
Washington, DC 20515

Gentlemen:

The Council of American Building Officials (CABO) has reviewed and is offering comments on H.R. 1066, Indoor Air Quality Act of 1991.

Section 15, Ventilation Standards for Public or Commercial Buildings of H.R. 1066 sets specific requirements for ventilation. Ventilation requirements are normally regulated by local and state government building codes. Establishing the requirements in federal law can create unnecessary duplication of and possibly conflict with local and state building code requirements.

Presumably, Congress would have to change the legislation if subsequent research showed that the requirements should be set at different values and the law would have to be enforced after construction. These are costly and time consuming processes.

The Council of American Building Officials strongly recommends that Section 15 be struck from H.R. 1066 so that the existing building code enforcement system may continue to perform its essential function of providing protection for the public health, safety and welfare in an economical manner.

In recent years, the Building Officials and Code Administrators International (BOCA), International Conference of Building Officials (ICBO) and Southern Building Code Congress International (SBCCI) have, through CABO, been working with the federal government to reduce the overlap and duplication of building and construction requirements between those of the federal agencies and those promulgated by the private sector. Today, the Department of Housing and Urban Development, Department of Veterans Affairs and the Farmers Home Administration of the Department of Agriculture are relying on the health and safety requirements in private sector codes and standards in keeping with the spirit and requirements of OMB Circular No. A-119. Reliance on the use of the health and safety requirements in private sector codes and standards is presently under consideration by the Department of Defense. Additionally the federal agencies are more actively participating in the processes of the model building code system, especially the Department of Housing and Urban Development which has become a member of BOCA, ICBO and SBCCI.

It is our desire and intent to continue these efforts in partnership with the federal government for there is no reason why the federal sector should promulgate duplicative and redundant guidelines.

To be most effective in achieving improved indoor air quality, appropriate regulations should be enforced at the time of design and construction, the requirements should be based on current research and thinking, and there should be a reasonable means of measurement available to insure that the requirements are met. There should also be the means for readily enforcing the regulations nationwide.

The building codes adopted by cities, counties and states throughout the nation are either one of the model building codes promulgated by BOCA, ICBO or SBCCI or the codes are largely based on those model codes. ASHRAE 62-89 has been proposed for adoption by those model building codes or the matter is under consideration. Consequently, it is likely that the requirements contained in H.R. 1066 will be contained in those codes before long. Then the government jurisdictions adopting the model codes will be adopting the requirements contained in H.R. 1066. As new research compels a change to the requirements it can be incorporated in the codes within a reasonable time frame. Use of the existing building code system also makes readily available a nationwide network of professional code enforcement personnel.

CABO has three members--Building Officials and Code Administrators International (BOCA), International Conference of Building Officials (ICBO) and Southern Building Code Congress International (SBCCI). These three model code organizations have more than 10,000 local and state building code jurisdictions as their principal members. It is the representatives of those members that determine the content of the model building codes and subsequently enforce the building codes as adopted by the local and state building code jurisdictions.

We appreciate the opportunity to comment on the legislation and will be available should other information be needed.

Sincerely,

Richard P. Kuchnicki

Richard P. Kuchnicki
President

RPK:kh

cc: CABO Executive Committee
Clarence R. Bechtel, Chief Executive Officer, BOCA
James E. Bihr, PE, President, ICBO
William J. Tangye, PE, Chief Executive Officer, SBCCI

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TESTIMONY
OF THE
BUSINESS COUNCIL ON INDOOR AIR

SUBMITTED
FOR THE RECORD

TO THE
SUBCOMMITTEE ON ENVIRONMENT
OF THE
COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES

REGARDING
THE INDOOR AIR QUALITY ACT OF 1991
(H.R. 1066)

May 9, 1991

Paul A. Cammer, Ph.D.
President

The Business Council on Indoor Air (BCIA) appreciates the opportunity to present its views on the Indoor Air Quality Act of 1991 (H. R. 1066). BCIA represents a wide spectrum of industries interested in indoor air quality. Our membership is composed of firms with analytical and engineering expertise in monitoring, controlling, and improving the quality of the indoor environment, companies that are owners of, and/or tenants in, a wide variety of commercial buildings and manufacturers of chemicals, consumer products, and building materials.

BCIA agrees with Congressman Joseph Kennedy and the other sponsors of H. R. 1066 that protecting indoor air quality is of primary importance. BCIA further agrees that federal resources should be directed at identifying indoor air quality problems and at finding the most efficient methods to remedy those problems.

In general, BCIA questions the need for indoor air legislation, in light of existing federal authorities and programs. We do not oppose legislation, however, that would better clarify and coordinate federal research and other activities directed at cost-effective solutions to indoor air quality problems.

Our testimony will address the specific issues raised by the new provisions of this legislation, including the requirements for ventilation standards for public and commercial buildings, contaminant emission rate labeling for certain products, evaluation of the need for further regulation to provide workplace indoor air quality protection, and baseline research on healthy buildings. In addition, this testimony will discuss interagency coordination of federal indoor air activities.

Ventilation Standards for Public and Commercial Buildings (Section 15)

Two of the most common factors in buildings with reports of poor indoor air quality are inadequate ventilation and poor filtration. Ventilation problems, in turn, can result from insufficient outdoor air intake and/or poor distribution of that air. Inadequate filtration is frequently a major contributor to the third most common problem: the accumulation of dirt, dust, and microbes inside the air handling units and their associated duct work. For example, a recent study by the Walter Reed Army Institute found that the incidence of respiratory infection was 50 percent higher in modern, energy-efficient buildings than in older, less airtight buildings.[1] According to the National Center for Health Statistics, such respiratory ailments accounted for one half of all absenteeism of the U.S. labor force between 1983 and 1985.[2]

Based on such information, the National Research Council (NRC) concluded in 1987 that "[t]he levels of both chemical and biological contaminants are strongly associated with the cleanliness of the heating, ventilation and air conditioning system."[3] More recently, the U.S. Environmental Protection Agency (EPA), in its 1989 Report to Congress, noted that "more can be done to reduce overall exposures and risks by altering building designs and ventilation patterns than by approaching the problem source-by-source or pollutant-by-pollutant."[4]

BCIA agrees with the conclusions of NRC and EPA, and has strongly supported the development of a "building-systems" approach to addressing potential indoor air quality problems. Such an approach focuses on the design, maintenance, and operation of ventilation, filtration, and other building systems, and encompasses the principles of several of the standards and guidelines developed by the American Society of Heating, Refrigerating and Air Conditioning Engineers (ASHRAE), including ASHRAE Standard 62-1989. Among its provisions, ASHRAE Standard 62-1989 increases the minimum ventilation rate to 20 cubic feet per minute of outside air per person (cfm/person) from the previous 5 cfm/person.[5]

The building-systems approach to indoor air quality is not just a matter of increased ventilation, however, but a comprehensive process that promises to improve air quality indoors with a minimum of expense and regulatory effort. In the case of new buildings, this approach commences at the building-design stage, continues through the construction and commissioning stages, and includes proper operator training and effective building operation and maintenance throughout the entire life of the building. For existing buildings, it includes testing, maintenance, and possible redesign of ventilation, filtration, heating, and air conditioning systems.

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[1] Brundage, J. et al., 1988, Building-Associated Risk of Febrile Acute Respiratory Diseases in Army Trainees, J. Am. Med. Assoc., 259(14): 2108-2112.

[2] National Center for Health Statistics, 1989, Vital and Health Statistics - Health Characteristics by Occupation and Industry: United States, 1983-85, Series 10, No. 170, Page 25.

[3] NRC, 1987, Policies and Procedures for Control of Indoor Air Quality.

[4] EPA, 1989, Report to Congress on Indoor Air Quality, Volume III - Indoor Air Research Needs, Page 3.

[5] ASHRAE Standard 62-1989, Ventilation for Acceptable Indoor Air Quality.

Section 15 of the proposed legislation recognizes, in part, the importance of the building-systems approach by establishing minimum ventilation requirements for new and renovated buildings and recordkeeping requirements for all buildings. The ventilation requirements of this section, however, do not distinguish among new and renovated building types, sizes, designs, locations, and configurations. By focusing on only a small aspect of the ASHRAE Standard, Section 15 does not provide sufficient flexibility for building owners and managers. Furthermore, the section does not address several of the other aspects of proper building-systems management.

BCIA supports the development of a uniform criteria relating to the proper design and maintenance of building systems that recognizes the inherent complexities in building design and engineering and the benefits of flexibility. We wish to note that such a process already is underway as an increasing number of regional and state building codes have adopted technology guidelines consistent with the ASHRAE Standard.[6] If a formal, technology-based standard is to be pursued, we believe a well-coordinated, joint effort among the key federal agencies is essential.

Contaminant Emissions Product Labeling (Section 16)

Public communication of information on potential health risks presents a difficult challenge to any federal program. BCIA agrees that it is important to communicate information to persons who are actually at risk from indoor air exposures that may result in adverse health effects. It is equally important, however, that the information accurately portray the potential health risks, and that it be provided in a form that can be readily understood and applied. It also is critical that the public have sufficient context in which to evaluate the information they are given.

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[6] In most cases, these codes do not encompass the operation and maintenance of building systems, and further efforts to encourage a uniform approach to this issue would be helpful.

H. R. 1066 contains two major public communications programs. The first would require the development of health advisories, and has been a part of indoor air legislation since it was first introduced. The second program is a recent addition that would require that certain products include labeling that would describe the emission rate of indoor air contaminants.

BCIA believes that additional labeling authority is not necessary. Moreover, we have several concerns about the product labeling requirements that have been added to the House legislation. Specifically, we question the utility of emission-rate data and the advisability of a consumer education program to emphasize the selection of products with lower emission rates.

EPA, the Consumer Product Safety Commission (CPSC), and the Occupational Safety and Health Administration (OSHA) currently may require product labeling under the authorities of the Toxic Substances Control Act (TSCA), the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), the Federal Hazardous Substances Act (FHSA), and the Occupational Safety and Health Act, respectively. Section 6 of TSCA grants EPA the authority to require labeling of articles containing substances or mixtures determined to "present an unreasonable risk of injury to health or the environment." EPA's Office of Toxic Substances referenced this authority when it began the ongoing "policy dialogue" with the carpet industry to investigate volatile organic compound (VOC) emissions from carpets.[7] Under the authority granted to it by Section 3 of FIFRA, EPA requires that pesticide product labels include warning and precautionary statements, a statement of hazards to humans, and directions for safe use.

Under Section 2 of FHSA, CPSC requires that consumer products containing hazardous substances bear a label that includes a warning, an affirmative statement of the principal hazard or hazards, and precautionary measures describing actions to be followed or avoided. CPSC also has drafted criteria and guidelines to codify current policy for determining whether a consumer product presents a potential chronic hazard under the requirements of the Labeling of Hazardous Art Materials Act passed by Congress in 1988. These guidelines will be applied to all consumer products, and will provide systematic guidance for determining whether the labeling requirements of FHSA are triggered for specific products.

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[7] Federal Register, 1990, Vol. 55(79), April 24, Page 17408.

In addition, OSHA's Hazard Communication Standard requires that all non-consumer and non-drug products containing certain hazardous substances bear labels indicating the potential health and physical hazards of the product.

Section 16 currently targets several specific product types for emission-rate labeling. All of these products have been, or are being, addressed under existing federal regulatory authority (i.e., pesticides) or through voluntary programs (i.e., carpets, combustion appliances, pressed wood products). As the other product type identified in the legislation (i.e., products containing solvents) encompasses such a large number and variety of products, it is beyond the scope of this testimony to list federal efforts in this area.

BCIA does not believe that emission-rate data for indoor air contaminants will provide the public with information that it can use effectively to reduce exposures to these contaminants. More importantly, reduction in emission rate may not necessarily result in exposure reduction or safer products. For solvent-containing products, exposure will depend to a large extent on how the product is used, rather than on the specific formulation. For example, a product with half the concentration (and half the emission rate) of a solvent compared with competing products may require that twice as much be used in order to be effective. BCIA believes, therefore, that instructions for safe use are far more valuable than an emission-rate value. In fact, existing labeling requirements under both FHSA and FIFRA specify that directions for proper use be included on the label.

For these reasons, BCIA also is concerned about the development of a consumer education program to emphasize the importance of low-emission products without consideration of product safety and efficacy. Even in cases where emission rate data can provide some basis for comparison between competing products, they do not provide a context in which to evaluate indoor exposures resulting from that product relative to other potential indoor exposures.

The other major question concerning the implementation of such a labeling program for emission rates is the basis for determining that a significant health threat exists. Do the authors intend that labeling be based on emissions of the total number of contaminants (VOCs, combustion products, etc.), on the assumption that all contaminants pose a significant health threat? If not, is the intent to focus on a short list of specific contaminants, or on a large number of contaminants? BCIA has concerns about all of these options.

Combining the emission rates of all contaminants into one value does not distinguish among the potential health effects of the various contaminants. Moreover, a total contaminant approach would tie the hands of a product formulator in evaluating alternative substances. Specifying a long list of substances subject to the emission-rate labeling requirements similarly does not provide any basis for relative comparisons, and would dilute the effectiveness of the labeling. Alternatively, specifying a short list of contaminants would imply that products not emitting these few contaminants are "safe." While these problems are not unique to the labeling program specified in Section 16, they cast further doubt on the effectiveness of such a program in improving indoor air quality.

Workplace Indoor Air Quality Protection (Section 17)

Section 17 of the proposed legislation would require an evaluation of the need for standards on workplace indoor air quality to protect the health and safety of employees. If it is determined that such a standard is necessary, the legislation prescribes those provisions that must be included. The evaluation is to be conducted by the Department of Labor, in conjunction with EPA and the National Institute for Occupational Health and Safety.

BCIA agrees with the intent of this section and, in fact, has encouraged OSHA to initiate a rulemaking on indoor air quality.[8] We disagree, however, with the apparent attempt by the section's authors to presuppose the conclusions of the regulatory review. Such prescriptive language preempts the regulatory process and is inconsistent with the implementation of an efficient national indoor air quality policy.

Section 17 also requires the evaluation of worker indoor air quality protection to include the cumulative, synergistic, or combination effects of indoor air contaminants present in workplace air. As outlined above, BCIA does not regard such a source-by-source or pollutant-by-pollutant approach to be a cost-effective method for improving general indoor air quality.

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[8] OSHA has announced its intent to issue a call for information on indoor air issues later this year.

Evaluation of the cumulative and synergistic effects of indoor air contaminants would require the development of a risk management framework for assessing simultaneous exposures to low levels of multiple indoor air contaminants from multiple sources. No adequate framework has ever been developed or validated to reflect such human risk from low levels of exposure to pollutants in changing indoor environments, and it is very unlikely that one can be developed in the near future, primarily because of our inadequate understanding of the biological mechanisms underlying potential health effects.

Healthy Buildings Baseline Study (Section 5(i))

We fully agree that further research on indoor air quality is needed. We believe, however, that research and mitigation efforts should be prioritized and focused, so that the most promising steps to protecting and improving indoor air quality can be identified, evaluated, and implemented. One of the highest priorities for federal research should be the development of baseline data for evaluating indoor air quality.

Monitoring data collected over the past ten years by EPA show concentrations of some contaminants to be considerably higher indoors than outdoors. These studies, such as EPA's Total Exposure Assessment Methodology (TEAM) research program,[9] have not addressed the broad range of indoor air contaminants, however, nor have they incorporated consideration of ventilation conditions and other mechanical systems in the buildings in which the measurements were taken.

Without the knowledge of the ventilation and other building systems at monitoring sites or the health and comfort of occupants, it is difficult to assess the significance of TEAM and other data to evaluate potential remedial actions. It is equally difficult to assess the contribution of particular sources of contaminants without first developing some baseline against which it can be compared.

To establish an acceptable baseline for comparing and assessing indoor monitoring data, BCIA proposes the development of a federal research project to evaluate indoor air quality in buildings that comply with the generally accepted principles incorporated in our building-systems approach. Such a program, to be conducted by EPA and NIOSH in cooperation with private industry, would build on the existing research to include the following significant additions: (1) the buildings to be sampled would be selected on the basis of compliance with the building-systems approach, and (2) the list of contaminants to be monitored would be expanded to include biological contaminants, respirable particulates, carbon monoxide, and carbon dioxide. The study also should include an evaluation of the buildings' indoor air quality histories, including the health and comfort of building occupants.

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[9] Wallace, L. A., 1987, The Total Exposure Assessment Methodology (TEAM) Study: Summary and Analysis, Vol. I, EPA Office of Research and Development, EPA/600/6-87/002a.

Interagency Jurisdictional Issues

While EPA may have devoted the most resources to indoor air quality, other federal agencies also are engaged in indoor air activities. As a consequence, many jurisdictional issues will arise as we attempt to develop a comprehensive federal indoor air quality program. Earlier versions of indoor air legislation have tended to assign most of the authority for implementing such a program to EPA. Subsequent revisions have recognized roles for OSHA, CPSC, NIOSH, and other agencies.

Coordination of federal indoor air activities through the Council for Indoor Air Quality (CIAQ) is essential. While direct interaction among high level representatives of the CIAQ member agencies is important, BCIA believes it would be advantageous to formalize a few working committees of mid-level representatives on key issues. These working committees would be chaired by a representative from the most appropriate agency. We wish to offer the following examples of committees that should be considered:

> Research - This group would examine the broad scope of proposed research, prioritize the projects, and coordinate the conduct of the research programs.
> (Chair - EPA and/or NIOSH)
>
> Workplace Indoor Air Quality - This group would focus on workplace guidelines and/or rulemakings, as well as worker information programs.
> (Chair - OSHA)
>
> Consumer Education - This group would coordinate all consumer information programs.
> (Chair - CPSC)

In addition, other agencies such as the Departments of Energy and Housing and Urban Development need to be active on these committees.

In developing a national response strategy, it is important that each agency be given the lead role in its area of expertise, while coordinating its activities with the other agencies. BCIA does not believe that insufficient funding is an acceptable reason for failure to assign authority to the proper agency.

BCIA also supports the continued involvement of EPA's Science Advisory Board (SAB) in indoor air issues. We believe that the Indoor Air Quality and Total Human Exposure Committee of the Board has considerable technical expertise. This Committee can add the necessary component of independent, external review and oversight to the complex array of different, yet often overlapping, federal indoor air programs. In fact, BCIA has submitted recommendations to EPA officials urging the Agency to propose that the role of SAB's indoor air committee be expanded to oversee coordination of indoor air research across the federal government.

Conclusion

BCIA is convinced that technology-based criteria based on the total building-systems approach outlined in this testimony has the best chance of improving indoor air quality in the near future. Other, more traditional, approaches would lead to high costs for little or no gain. A well-coordinated federal program, aimed at developing uniform guidelines and conducted in cooperation with industry, academia, and state entities, is both promising and achievable.

CRI
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TESTIMONY SUBMITTED BY
RONALD E. VANGELDEREN, PRESIDENT, THE CARPET AND RUG INSTITUTE
MAY 9, 1991
TO THE SUBCOMMITTEE ON ENVIRONMENT
OF THE COMMITTEE ON SCIENCE, SPACE AND TECHNOLOGY
UNITED STATES HOUSE OF REPRESENTATIVES

Thank you for providing The Carpet and Rug Institute with an opportunity to present this testimony on the issue of carpet and H. R. 1066, the Indoor Air Quality Act of 1991. The Carpet and Rug Institute (CRI) is comprised of carpet manufacturers who represent 95 percent of all carpet produced in the United States.

We applaud the committee's work pertaining to the issue of indoor air quality, and we are firmly in support of steps to reduce any risk posed to Americans from unhealthy indoor air quality. While we have specific comments on H. R. 1066, first allow us to provide the committee with important information on the carpet industry and its role in the indoor air quality debate.

The carpet and rug industry produces on average 1.2 billion square yards of carpet every year and employs approximately 400,000 Americans across the country, engaged in producing face fiber, latex, dyestuffs, backing, carpet manufacturing, finishing, samples, flooring adhesives and sealants, carpet cushion, as well as distribution, retailing, installation, and cleaning. Rugs have been used since time began and carpet, as we know it today, has been used in homes and offices across the country and throughout the world since the late 1800's. In fact, it is estimated that more than 70 percent of all floor space in the United States and 120 million households use carpet and/or rugs for their comfort and aesthetic appeal. Simply put, we think carpet ranks up there with apple pie in terms of its role in American lifestyles.

As an industry, we pride ourselves in providing a safe product which has added considerably to the well-being and protection in the lives of consumers.

Carpet, since 1972, meets very stringent flammability standards, making it almost impossible for carpet to propagate a fire and usually helps to contain such a threat.

When formaldehyde became an issue, the carpet industry voluntarily took it out of the manufacturing process over a decade ago, even though the quantities used were so minute that they could not have created adverse health effects. Formaldehyde has not been used in the carpet manufacturing process since then and, therefore, is not an issue.

Starting in 1983, carpet has been tested for combustion toxicity, which has demonstrated carpet to retard the development of toxic smoke, providing occupants with more precious time to escape the hazard.

Not resting on our laurels and continuing the industry's commitment to providing the best possible products, the attention of the industry has been focused on indoor air quality since 1987.

Because we Americans now spend 90 percent of our time indoors, we feel that indoor air quality is exceedingly important and have positioned ourselves at the leading edge of this issue by researching the behavioral characteristics of carpet as it relates to indoor air quality. Meanwhile, the carpet and rug industry has been very concerned about the misinformation which has been circulating concerning the relationship between our products and indoor air quality. Please allow us to put this in its proper perspective.

We believe the misconception about carpet began when some individuals, drawn to the presence of the distinct odor given off by new carpet, very much like a new car smell, considered it unpleasant and in some instances perceived this odor to be the probable cause of their irritation. This has triggered a number of conclusions not based on fact. Actually, the odor is caused by an unavoidable by-product of the manufacturing process for styrene butadiene latex, supplied to carpet manufacturers and used as a binding agent to lock the face fiber tufts into the carpet backing. This by-product is known as 4-Phenylcyclohexene or 4-PCH. The emission of 4-PCH found in slight quantities with new carpet, in most cases, ceases to be noticeable within 48-72 hours after installation and can be dramatically reduced by increased ventilation during this time frame.

It is important to note that 4-PCH, even though harmless, has been found objectionable by a relatively small number of people who appear to be suffering from unusual allergies or sensitivities which fall into a newly created category referred to as Multiple Chemical Sensitivity (MCS). The medical community has been unable to pinpoint the cause of these sensitivities; however, the carpet industry, in its commitment to its customers, felt impelled to ask the latex manufacturers for the removal and/or reduction of 4-PCH.

The latex manufacturers responded by finding ways and means through their manufacturing process to reduce the content of 4-PCH by more than 50 percent.

The latex manufacturers also responded to this request by conducting a number of tests of this compound to determine its health effects. The results of these tests concluded that exposure to 4-PCH in quantities of 100-1000 times more than any one of us will ever experience proved no respiratory or dermal effects as reported in:

> "4-Phenylcyclohexene: Dermal Sensitization Potential in the Hartley Albino Guinea Pig" by M. J. Mizell, May 10, 1989
>
> "4-Phenylcyclohexene: Acute Inhalation Toxicity Study in Fischer 344 Rats" by K. D. Nitschke, M. J. Beekman and L. G. Lomax, August 9, 1989
>
> "4-Phenylcyclohexene: Two-Week Inhalation Toxicity Study in Fischer 344 Rats" by L. G. Lomax, K. D. Nitschke, M. J. Beekman, P. J. Spencer and S. K. Weiss, August 11, 1989.

These studies could be useful to the committee and the public at large to correct some of the misunderstandings about this issue.

Experts now agree that indoor air quality may deteriorate with inadequate ventilation in our homes and offices. Leakproof windows that cannot be opened, airtight seals around doors and openings to the out-of-doors, climate control air conditioning without the adequate introduction of fresh air, and other technological advances have often made the air inside less than fresh.

As an industry, we are committed to preventing carpet from contributing to poor indoor air quality.

In 1989, as part of our commitment, CRI commissioned an independent study to more fully understand emissions from carpet and indoor air quality. Nineteen representative products with styrene butadiene latex were tested, which provided a snapshot and perspective of these products in relationship to each other and other common household products.

First of all, this testing program demonstrated that carpets have extremely low emission factors. Second, that carpet emissions drop dramatically within the first 24-48 hours and become practically undetectable thereafter. Third, carpet emissions, at their peak, are well below suggested levels of acceptance proposed by leading government and private researchers. Fourth, carpet emissions can be even more drastically reduced through the introduction of ventilation and the introduction of fresh air. Finally, the total of all carpet emissions is as much as 500-1000 times less than other household products such as paint, wallpaper, floor waxes, adhesives, etc. These conclusions and more detailed elaboration of this research are part of the final report on this first study entitled:

> "Volatile Organic Compound Emissions from Carpet and Associated Products," by Dr. Marilyn S. Black, William J. Pearson and Lydia M. Work of Air Quality Sciences, Inc., January 8, 1991.

Testing for indoor air quality and product emission requires very sophisticated high tech testing equipment and instrumentation. The method used for the findings described herein were developed by the U. S. Environmental Protection Agency, Georgia Institute of Technology, and further refined by Dr. Marilyn Black of Air Quality Sciences. This methodology entitled:

> "ASTM Guide for Determining Volatile Organic Compound Emission Factors from Carpet and Associated Materials Under Defined Testing Conditions Using Small Environmental Chambers"

is currently in the process of submittal and review for adoption by the American Society for Testing and Materials (ASTM). Utilization of this leading edge technology is very expensive but deemed necessary in order to achieve accurate and meaningful results. This environmental chamber technology has also been reviewed by the U. S. EPA Carpet Policy Dialogue participants who achieved consensus in submitting the protocol to ASTM as a viable measuring technique. CRI, on behalf of the carpet industry, is extremely proud to be a part of using this leading edge technology.

As part of our commitment, CRI has been working collaboratively on a voluntary basis with the Environmental Protection Agency (EPA) and the Consumer Product Safety Commission (CPSC).

CRI's involvement with the research section of the EPA dates back to 1987. It was materially intensified several years ago when the EPA building at Waterside Mall experienced indoor air quality problems. Several agency employees alleged that they became ill during the installation of new carpet in sections of the building that were being redecorated. The National Federation of Federal Employees, as the union representing these employees, filed a petition in January of 1990 asking the EPA to investigate the cause of these problems and to regulate carpet.

A thorough investigation of the EPA Waterside Mall building revealed it as a prime example of how ventilation can play an important role in exacerbating poor indoor air quality. The building's ventilation system was designed to meet energy saving requirements by reducing the fresh air intake and was also found to contain mold and other contaminants. Furthermore, the building was built as an apartment building to accommodate 1000 residents where now more than 5000 government employees are housed. These conditions, along with inadequate maintenance over the years, created a less than perfect environment with extremely poor air quality. The customary new carpet odor during installation simply drew attention to the already existing problems.

The official response by the EPA to this petition determined a lack of evidence to support regulation of carpet but recognized an overall need to reduce total emissions from all sources. In further response to the petition, the EPA Administrator, through a notice in the Federal Register, called on the carpet industry, consumer groups, and other interested parties to enter into a year long dialogue process for the development of strategies for reducing total overall emissions from carpet and carpet related products referred to as "the Carpet Policy Dialogue."

CRI's initial voluntary testing program was started five months prior to the Dialogue. Because it was completed during the Dialogue and contained a lot of useful data, CRI was asked to present and agreed to share its findings with the Dialogue group, which greatly added to the understanding of this issue.

Furthermore, on October 25, 1990, The Carpet and Rug Institute voluntarily offered a comprehensive program for implementation, designed to conduct further testing for total volatile organic compound (TVOC) emission levels from a variety of carpet and carpet related products, plus a number of follow-up programs. The five components of this program are:

1. Generation of a representative TVOC base for carpet products;
2. Presentation of this data base to the U. S. EPA with a profile of carpet emissions derived from Item (1);
3. Generation of a history of TVOC levels through on-going periodic monitoring which would be available for

trend analysis and further appropriate actions;

4. Motivation of manufacturers to institute voluntary quality assurance measures to reduce TVOC emissions through a CRI established certification program as their contribution to better indoor air quality and product consistency;
5. Providing information on a periodic basis to the general public and carpet customers regarding the quality assurance and certification program, product use, importance of indoor air quality, and the answering of consumer questions.

This proposal and commitment by the industry has been extensively discussed and reviewed, resulting in a consensus from the Carpet Policy Dialogue group for adoption by the U. S. EPA. The industry is anxious to proceed with this program because, once complete, the testing results will provide a solid scientific information base on which the industry and consumers can make decisions relative to carpet and its role toward the improvement of indoor air quality.

CRI believes this testing program and its commitment for the development and distribution of consumer information are elements in its continuing program of responsible product stewardship.

It should be noted that similar programs will be implemented by the floor adhesive and carpet cushion manufacturing elements of the carpet industry.

CRI has also been working with the Consumer Product Safety Commission (CPSC). In 1989 the CPSC advised CRI that it had received 35 reports over a course of eight years which purported involvement with carpet. CRI immediately agreed to cooperate with a CPSC proposed research program. Soon thereafter, the CPSC specifically solicited consumers, epidemiologists, and allergists to call an 800 number to report cases involving adverse health effects which might possibly be related to carpet. This resulted in a number of additional reports. So, over the course of the nine-year complaint record, voluntary and solicited, the CPSC received approximately 500 reports, of which 206 were investigated as related to carpet. During this same nine-year period, more than ten billion square yards of carpet were installed. Upon completion of its analysis, the CPSC concluded that they could not establish any cause-and-effect relationship between the symptoms reported and carpet. Nevertheless, CRI is continuing its offer to assist the CPSC with these investigations and the research program.

The complaints made to the CPSC highlight the difficulty of trying to pinpoint a link between adverse health effects and emissions from carpet. The medical community has had great difficulty in identifying specific causes of ill health effects related to indoor air quality. It is extremely difficult to determine whether or not eye irritations, respiratory irritations, sneezing, fatigue, etc., are caused from dust, bacteria, fungus, airborne particles, hay fever, or just simply due to a cold or flu. Part of the problem is that physical symptoms which reflect poor indoor air quality are the same, regardless of what source may be perceived as causing them. Obviously, as research continues, we all hope that the answers will be forthcoming in a factual, scientific manner rather than dealing in speculation, conjecture, and allegation.

While CRI has been working closely with industry leaders, government agencies, and scientists to evaluate carpet's behavioral characteristics, emissions, and indoor air quality, it has also initiated communication, education, and research efforts with carpet installers, cleaners, and customers. These efforts have been focused on proper installation, specific environmental recommendations, minimum standards, and the maintenance of carpet.

Unfortunately, despite all of these efforts, a lot of misinformation about carpet seems to evolve such as the recent news release by the New York State Attorney General's office reporting two fatalities while installing carpet. When the facts were finally uncovered, it turned out that the two individuals were each engaged in using a contact cement containing trichloroethane, which is not recommended for carpet installation. They were both using this in close quarters on their boats inside a closed building without ventilation.

A cornerstone of our consumer outreach effort is a set of guidelines for carpet installation. First published in 1982, and periodically updated since. When reissued in 1990, the new carpet installation guidelines specifically stressed the importance of common sense ventilation prior to, during, and immediately after the installation. We are proud of these guidelines which were written with the input from all segments of the industry to include manufacturers, distributors, suppliers, retailers, and installers.

These guidelines also include a checklist which helps consumers know exactly what to expect at the time of installation and gives tips for assuring trouble free installations. Guidelines for proper ventilation and environmental conditions during installation are covered at length in this section to include:

> "As with many new products, new carpet may initially have a slight odor. This is normal. Adhesives or hot melt seaming tapes used to install the carpet may have a slight odor while they are curing. Existing carpet or cushion, while being removed, may create an odor.
>
> All removal or installation processes are best handled under optimum fresh air ventilation conditions. During installation, be sure that windows and doors are open. Ideally, the heating/air conditioning/ventilation system should be operating at normal room temperature with maximum fan speed.
>
> If you, a member of your family, or other occupants are sensitive to certain odors, you may wish to ventilate the premises with fresh air by opening windows and doors and operating the ventilation system at normal room

> temperature with fan speed at maximum capacity for at least 48-72 hours after the installation. This will help eliminate the existence of any lingering odors."

A leading trade publication (Eastern Floors, Fall 1990) says about the CRI Installation Guide: "It sets a standard of excellence, one that puts the professionals up on top. It is an important key to the improvement of residential installation, consumer satisfaction, and repeat business." We believe these efforts to educate installers and retailers are critical because they are the individuals who are in touch with consumers.

CRI is also undertaking a comprehensive consumer education program, which includes point of purchase materials and educational brochures with questions and answers about carpet and indoor air quality. We believe this is the most effective means of educating consumers about the importance of ventilation as the means of eliminating new carpet odor, addressing environmental concerns, and assuring safe practices.

Specific to H. R. 1066, CRI supports the conduct of meaningful indoor air quality research and the development of information regarding potential adverse health effects to help those who might be particularly susceptible. As an industry, we will continue to aggressively pursue an understanding of our products and methods by which they can be improved to reduce emissions and improve the quality of indoor air. There is a great deal that is unknown at this time and further research will enable all of us to act from a more informed perspective and in a responsible manner.

With regard to the changes in the Bill from last year to this year, we feel that it is unreasonable to require product labeling. We believe consumer-use-information is critical, but we also believe that product labeling without a thorough understanding of specific cause-and-effect relationships of products to people is very confusing. Labeling would simply alarm the public rather than educate them on this issue. Labeling should only be considered when it can be proven that a specific product causes significant adverse health effects. Labeling should not be applied to a product such as carpet which, based on scientific research, has extremely low emission rates and cannot be linked as a significant contributor.

The labeling provision may well be intended to help the consumer make informed decisions, but it is not very practical and fraught with troublesome consequences. For labeling to be effective, the information that is included must be understandable to the consumer. The mere inclusion of test results regarding concentration levels of emissions or other information not put into useful and meaningful perspectives will only lead to a confused and frightened consumer.

Even the listing in the current Bill of product categories might unduly frighten consumers, harm industries employing thousands of people, and ultimately create an atmosphere of disbelief of any information which may be written on such a label.

We believe that industry people who deal with consumers can be very effective if armed with educational materials, consumer brochures, and responsible answers to questions. The carpet industry, as one, plans to put its resources to work to inform its customers. Please, allow us to do so voluntarily and in a responsible fashion. Premature regulation would be counter productive.

Comprehensive research with defined objectives to be achieved within a reasonable time frame have and will arm us with pertinent facts and information which, in turn, will help to expedite the implementation of practical solutions in a responsible manner. To wit, we feel that it was the research and testing by and for The Carpet and Rug Institute, both in the private and public sectors, which has given all of us a better understanding of carpet and its behavioral characteristics. The resultant findings allowed the carpet industry to put its expertise to work in developing a better environment indoors, such as reducing 4-PCH by 50 percent, such as reformulating adhesives without solvents, and urging the use of fresh air ventilation during and after installation. Research and testing established the fact that TVOC emissions from new carpet are extremely small and become almost immeasurable. And, we sincerely hope that the findings of this research, properly communicated to the consumer, will help to correct some of the misperceptions, misunderstandings, and questions about our products.

The carpet and rug industry is an old and established industry which has provided Americans with safe products for decades. We understand the need for improving the quality of indoor air and the need for this review publicly. Scientific research and doing everything we can to obtain a thorough understanding of our products, their behavioral characteristics, and their contribution to improving the quality of indoor air is an ongoing commitment.

We believe that the Indoor Air Quality Act, as originally drafted with its emphasis on research and the dissemination of factual information, without mandated labeling, will accomplish these objectives more expeditiously. We urge your adoption accordingly.

Thank you for your time, Mr. Chairman. I would be happy to take any questions.

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PRESIDENT
JAMES E. BIHR, P.E.
EXECUTIVE VICE-PRESIDENT
RONALD B. WATSON, P.E.

May 21, 1991

Subcommittee on Environment
Science, Space and Technology Committee
House Annex 2, Room 388
Washington D.C. 20515

Dear Committee Members,

I would like to offer some comments on H.R. 1066, known as the "Indoor Air Quality Act of 1991."

Our organization promulgates the Uniform Building Code and the Uniform Mechanical Code, which are used in about the western two thirds of the country. For many years the code has contained ventilation requirements for buildings. Recently, the ICBO Indoor Air Quality Code Development Committee recommended extensive revisions to the ventilation provisions which will be considered by our membership at our 69th Annual Education and Code Development Conference September 8-13, 1991, in Spokane, Washington. A copy of the proposed ventilation requirements which are based on American Society of Heating, Refrigeration and Air-Conditioning Engineers (ASHRAE) Standard 62-89 is attached.

The portion of the bill which involves federal agencies and others in research on this complex subject in commendable. However, it is our opinion that the federal government should encourage private consensus standards organizations to develop the appropriate ventilation rates and details as directed by OMB Circular A-119-1. By doing this, conflicting and overlapping regulations and duplication of effort will be avoided.

The retroactive ventilation provisions for public or commercial buildings are questionable and appear unenforceable. Ventilation requirements for new buildings should be left to state and local code enforcement agencies.

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Thank you for the opportunity to comment and if you have questions, please let me know.

Sincerely,

D. R. Watson, P.E.
Executive Vice-President

DRW:lmd

Enclosure

cc: Bob Spangler
Jim Bihr

A-5-91-?—I.A.Q. **Approval as Revised**

1. Sec. 510. Revise as follows:

Sanitation and Ventilation

Sec. 510. (a) Standards. The ventilation standards listed below ar guideline standards which are not adopted as part of this code (see Sections 6002 and 6003).

ASHRAE Standard 52

ASHRAE Standard 62

ASHRAE Standard 62a

~~(a)~~ (b) **Water Closet Separation. (Balance of subsection to remain unchanged.)**

~~(b)~~ (c) **Floors and Walls in Water Closet Compartment and Showers. (Balance of subsection to remain unchanged.)**

Add a Subsection (d) as follows:

(d) **Ventilation for Indoor Air Quality.** Acceptable indoor air quality shall be attained by providing outdoor ventilation air to occupied building areas as specified in Tables Nos. 6-A, 7-A, 8-A, 10-A and 12-A. Procedures specified in American Society of Heating, Refrigerating and Air-conditioning Engineers Standard 62 may be accepted in lieu of the specified outdoor air ventilation rates.

2. Chapter 60, Part III. Add references as follows:

ASHRAE Standard 52-1976, Method of Testing Air-cleaning Devices Used in General Ventilation for Removing Particulate Matter.

ASHRAE Standard 62-1989, Ventilation for Acceptable Indoor Air Quality.

ASHRAE Standard 62a-1989, Addendum to Ventilation for Acceptable Indoor Air Quality.

3. Sec. 605. Revise as follows:

All enclosed portions of Group A Occupancies customarily used by human beings and all dressing rooms shall be provided with natural light by means of exterior glazed openings with an area not less than one tenth of the total floor area, and natural ventilation by means of openable exterior openings with an area of not less than one twentieth of the total floor area, or shall be provided with artificial light and a mechanically operated ventilating system. The mechanically operated ventilating system shall be capable of supplying ~~a minimum of 5 cubic feet per minute per occupant in all portions of the building~~ outdoor ventilation air in accordance with Table No. 6-A during such time as the building is occupied. If the velocity of the air at the register exceeds 10 feet per second, the register shall be placed more than 8 feet above the floor directly beneath.

Toilet rooms shall be provided with a fully openable exterior window at least 3 square feet in area; or a vertical duct not less than 100 square inches in area for the first toilet facility, with 50 additional square inches for each additional facility; or a mechanically operated system capable of ~~providing a complete change of air every 15 minutes~~ supplying 50 cubic feet of outdoor ventilation air per minute for each water closet and urinal installed in the toilet room. Such systems shall be connected directly to the outside, and the point of discharge shall be at least 5 feet from any openable window.

There shall be provided in an approved location at least one lavatory for each two water closets for each sex, and at least one drinking fountain for each floor level.

> **EXCEPTION:** A drinking fountain need not be provided in a drinking or dining establishment.

For other requirements on water closets, see Sections 510 and 511.

4. Table No. 6-A. Add as follows:

TABLE NO. 6-A—VENTILATION RATE SCHEDULE[1,2]

GROUP A OCCUPANCIES	VENTILATION AIR (cfm/person unless noted)
Food and beverage service	
Bars, cocktail lounges	30
Cafeteria, fast food	20
Dining rooms	20
Kitchens (cooking)[3]	15
Sports and amusement	
Assembly rooms	15
Ballrooms and discos	25
Bowling alleys (seating areas)	25
Conference rooms	20
Gambling casinos	30
Game rooms	25
Ice arenas	0.50 cfm/ft.^{2}
Playing floors (gymnasium)	20
Spectator areas	15
Swimming pools (pool and deck area)	0.50 cfm/ft.^{2}
Theaters	
Auditorium	15
Lobbies	20
Stages, studios	15
Ticket booths	20
Transportation	
Platforms	15
Waiting rooms	15

[1] Occupant load shall be determined in accordance with Chapter 33.

[2] Applications may not be unique to a single occupancy group. Where specific use is not listed, judgment as to similarity shall be by the building official.

[3] The sum of the outdoor and transfer air of acceptable quality from adjacent spaces shall be sufficient to provide an exhaust rate of not less than 1.5 cubic feet per minute per square foot.

5. Sec. 705. Revise as follows:

In Group B Occupancy buildings, enclosed portions customarily occupied by human beings, other than rooms and areas for which requirements are specified elsewhere in this section, shall be provided with natural light by means of glazed exterior openings with an area equal to one tenth of the total floor area of such portions, and natural ventilation by means of exterior openings with an openable area of not less than one twentieth of the total floor area of such portions, or shall be provided with artificial light and a mechanically operated ventilating system. The mechanically operated ventilating system shall be capable of supplying ~~a minimum of 5 cubic feet per minute of outside air per occupant~~ outdoor ventilation air in accordance with Table No. 7-A in all occupied portions of the building.

In parking garages, other than open parking garages as defined in Section 709 (b), used for storing or handling of automobiles operating under their own power and on loading platforms in bus terminals, ventilation shall be provided capable of exhausting a minimum of 1.5 cubic feet per minute per square foot of gross floor area. The building official may approve an alternate ventilation system designed to exhaust a minimum of 14,000 cubic feet per minute for each operating vehicle.

Systems shall be based on the anticipated instantaneous movement rate of vehicles but not less than 2.5 percent (or one vehicle) of the garage capacity. Automatic carbon dioxide-sensing devices may be employed to modulate the ventilation system to maintain a maximum average concentration of carbon monoxide of 50 parts per million during an eight-hour period, with a maximum concentration not greater than 200 parts per million for a period not exceeding one hour. Connecting offices, waiting rooms, ticket booths and similar uses, shall be supplied with conditioned air under positive pressure.

> **EXCEPTION:** In gasoline service stations without lubrication pits, storage garages and aircraft hangars, the building official may authorize the omission of ventilating equipment when the building is supplied with unobstructed openings to the outer air which are sufficient to provide the necessary ventilation.

Buildings or portions thereof where persons are employed shall be provided with at least one water closet. Separate facilities shall be provided for each sex when the number of employees exceeds four and both sexes are employed. Such toilet facilities shall be located either in such building or conveniently in a building adjacent thereto on the same property.

Water closet rooms in connection with food establishments where food is prepared, stored or served shall have a nonabsorbent interior finish as specified in Section 510 (b), shall have hand-washing facilities therein or adjacent thereto, and shall be separated from food preparation or storage rooms as specified in Section 510 (a).

Toilet rooms shall be provided with a fully openable exterior window at least 3 square feet in area; or a vertical duct not less than 100 square inches in area for the first toilet facility, with 50 additional square inches for each additional facility; or a mechanically operated system capable of ~~providing a complete change of air every 15 minutes~~ supplying 50 cubic feet of outdoor ventilation air per minute for each water closet and urinal installed in the toilet room. Such systems shall be connected directly to the outside, and the point of discharge shall be at least 5 feet from any openable window. For other requirements on water closets, see Section 510.

6. Table No. 7-A. Add as follows:

TABLE NO. 7-A—VENTILATION RATE SCHEDULE[1,2]

GROUP B OCCUPANCIES	VENTILATION AIR (cfm/person unless noted)
Division 1	
Enclosed parking garages	1.50 cfm/ft.^{2}
Division 2	
Stores, sales floors and show room floors	
Basement and street levels	0.30 cfm/ft.^{2}
Upper levels	0.20 cfm/ft.^{2}
Dressing rooms	0.20 cfm/ft.^{2}
Malls and arcades	0.20 cfm/ft.^{2}
Shipping and receiving areas	0.15 cfm/ft.^{2}
Smoking lounges	60
Storage rooms	0.15 cfm/ft.^{2}
Warehouses	0.05 cfm/ft.^{2}
Specialty shops	
Barber shops	15
Beauty shops	25
Clothiers	0.30 cfm/ft.^{2}
Furniture stores	0.30 cfm/ft.^{2}
Florists	15
Hardware stores	15
Drug stores	15
Fabric stores	15
Pet shops	1.00 cfm/ft.^{2}
Reducing salons	15
Food stores	15
Dry cleaners, laundries	
Coin-operated dry cleaners	15
Coin-operated laundries	15
Commercial dry cleaners	30
Commercial laundries	25
Storage, pick-up areas	35
Offices	
Conference rooms	20
Office spaces	20
Reception areas	15
Telecommunication centers and data entry spaces	20
Corridors and utilities	0.05 cfm/ft.^{2}
Elevators	1.00 cfm/ft.^{2}
Locker and dressing rooms	0.50 cfm/ft.^{2}
Public restrooms (per water closet or urinal)	50
Smoking lounges	60
Bank vaults	15
Factories, workshops	
Darkrooms	0.50 cfm/ft.^{2}
Duplicating, printing areas	0.50 cfm/ft.^{2}
Meat processing areas	15
Pharmacies	15
Photo studios	15

[1] Occupant load shall be determined in accordance with Chapter 33.

[2] Applications may not be unique to a single occupancy group. Where specific use is not listed, judgment as to similarity shall be by the building official.

7. Sec. 805. Revise as follows:

Group E Occupancies shall be provided with ~~light and ventilation, either natural or artificial, as specified in Section 605~~ natural light by means of exterior glazed openings with an area not less than one tenth of the total floor area, and natural ventilation by means of openable exterior openings with an area of not less than one twentieth of the total floor area, or shall be provided with artificial light and a mechanically operated ventilating system. The mechanically operated ventilating system shall be capable of supplying outdoor ventilation air in accordance with Table No. 8-A during such time as the building is occupied. If the velocity of the air at the register exceeds 10 feet per second, the register shall be placed more than 8 feet above the floor directly beneath.

Toilet rooms shall be provided with a fully openable exterior window at least 3 square feet in area; or a vertical duct not less than 100 square inches in area for the first toilet facility, with 50 additional square inches for each additional facility; or a mechanically operated exhaust system capable of exhausting 50 cubic feet of air per minute for each water closet and urinal installed in the toilet room. Mechanical exhaust systems shall be connected directly to the outside, and the point of discharge shall be at least 5 feet from openable windows.

Water closets shall be provided on the basis of the following ratio of water closets to the number of students:

	Boys	Girls
Elementary schools	1:100	1:35
Secondary schools	1:100	1:45

In addition, urinals shall be provided for boys on the basis of 1:30 in elementary and secondary schools.

There shall be provided at least one lavatory for each two water closets or urinals, and at least one drinking fountain on each floor of elementary and secondary schools.

For other requirements on water closets, see Section 510.

8. Table No. 8-A. Add as follows:

TABLE NO. 8-A—VENTILATION RATE SCHEDULE[1,2]

GROUP E OCCUPANCIES	VENTILATION AIR (cfm/person unless noted)
Educational	
Auditoriums	15
Classrooms	15
Corridors	0.10 cfm/ft.^{2}
Laboratories	20
Libraries	15
Locker rooms	0.50 cfm/ft.^{2}
Music rooms	15
Smoking lounges	60
Training shop	20

[1] Occupant load shall be determined in accordance with Chapter 33.

[2] Applications may not be unique to a single occupancy group. Where specific use is not listed, judgment as to similarity shall be by the building official.

9. Sec. 905. Revise as follows:

(c) **Ventilation in Group H, Division 4.** In buildings used for the repair or handling of motor vehicles operating under their own power, mechanical ventilation shall be provided capable of exhausting a minimum of 1.5 cubic ~~foot~~ feet per minute per square foot of floor area. Each engine repair stall shall be equipped with an exhaust pipe extension duct, extending to the outside of the building, which, if more than 10 feet in length, shall mechanically exhaust 300 cubic feet per minute. Connecting offices and waiting rooms shall be supplied with conditioned air under positive pressure.

> **EXCEPTION:** In repair garages, enclosed heliports and aircraft hangars, the building official may authorize the omission of ventilating equipment when the building is supplied with unobstructed openings to the outer air, which are well distributed and sufficient in size to provide the necessary ventilation.

(d) **Sanitation.** Buildings or portions thereof where persons are employed shall be provided with at least one water closet. Toilet facilities shall be located either in the building or conveniently in a building adjacent thereto on the same property.

Toilet rooms shall be provided with a fully operable exterior window at least 3 square feet in area; or a vertical duct not less than 100 square inches in area for the first water closet, with 50 additional square inches for each additional fixture; or a mechanically operated exhaust system capable of ~~providing a complete change of air every 15 minutes~~ exhausting 50 cubic feet of air per minute for each water closet and urinal installed in the toilet room. Such systems shall be connected directly to the outside, and the point of discharge shall be at least 5 feet from any openable window.

For all other requirements on water closets, see Sections 510 and 511.

10. Sec. 1005. Revise as follows:

Group I Occupancies customarily used by human beings shall be provided with natural light by means of exterior glazed openings with an area equal to one tenth of the total floor area, and natural ventilation by means of exterior openings with an area not less than one twentieth of the total floor area, or shall be provided with artificial light and a mechanically operated ventilating system ~~as specified in Section 605~~. The mechanically operated ventilating system shall be capable of supplying outdoor ventilation air in accordance with Table No. 10-A during the time the building is occupied. If the velocity of the air at the register exceeds 10 feet per second, the register shall be placed more than 8 feet above the floor directly beneath.

For other requirements on water closets, see Section 510.

11. Table No. 10-A. Add as follows:

TABLE NO. 10-A—VENTILATION RATE SCHEDULE[1,2]

GROUP I OCCUPANCIES	VENTILATION AIR (cfm/person unless noted)
Hospitals, nursing and convalescent homes	
Autopsy rooms	0.50 cfm/ft.^{2}
Medical procedure rooms	15
Operating rooms	30
Patient rooms	25
Physical therapy rooms	15
Recovery and ICU rooms	15
Correction facilities	
Cells	20
Dining halls	15
Guard stations	15

[1] Occupant load shall be determined in accordance with Chapter 33.

[2] Applications may not be unique to a single occupancy group. Where specific use is not listed, judgment as to similarity shall be by the building official.

12. Sec. 1205. Revise as follows:

(c) **Ventilation.** Guest rooms, dormitories and habitable rooms within a dwelling unit shall be provided with natural ventilation by means of openable exterior openings having an area at least one twentieth of the floor area of the rooms with a minimum of 5 square feet.

In lieu of required exterior openings for natural ventilation, a mechanical ventilating system may be provided. A mechanical ventilating system shall be capable of providing ~~two air changes per hour in all guest rooms, dormitories, habitable rooms and in public corridors. One fifth of the air supply shall be taken from the outside~~ outdoor ventilation air in accordance with Table No. 12-A.

Bathrooms, water closet compartments, laundry rooms and similar rooms shall be provided with natural ventilation by means of openable exterior openings having an area at least one twentieth of the floor area of the rooms with a minimum of 1½ square feet.

In lieu of required exterior openings for natural ventilation in bathrooms containing a bathtub or shower or combination thereof, laundry rooms and similar rooms, a mechanical ventilation system connected directly to the outside capable of ~~providing five air changes per hour~~ supplying outdoor ventilation air in accordance with Table No. 12-A shall be provided. The point of discharge of exhaust air shall be at least 5 feet from a mechanical ventilating intake. Bathrooms which contain only a water closet or lavatory or combination thereof and similar rooms may be ventilated with an approved mechanical recirculating fan or similar device designed to remove odors from the air.

13. Table No. 12-A. Add as follows:

TABLE NO. 12-A—VENTILATION RATE SCHEDULE[1,2]

GROUP R OCCUPANCIES	VENTILATION AIR (cfm/person unless noted)
Division 1	
Hotels, Motels, Resorts, Dormitories	
Assembly rooms	15
Conference rooms	20
Lobbies	15
Living rooms	30 cfm/room[3]
Bedrooms	30 cfm/room[3]
Private bathrooms (intermittent exhaust)	35 cfm/room[3]
Dormitory sleeping rooms	15
Division 1	
Apartment Houses and	
Division 3	
Dwellings and Lodging Houses	
Living areas	0.35 ach[4]
Kitchens (intermittent exhaust)	100 cfm/room[3]
or (continuous exhaust)	25 cfm/room[3]
Bathrooms (intermittent exhaust)	50 cfm/room[3]
or (continuous exhaust)	20 cfm/room[3]

[1] Occupant load shall be determined in accordance with Chapter 33.

[2] Applications may not be unique to a single occupancy group. Where specific use is not listed, judgment as to similarity shall be by the building official.

[3] Independent of room size.

[4] Air changes per hour, but not less than 15 cubic feet per minute per person.

Reason: Though proposed for the appendices, the original submittal was criticized and opposed because it was considered unenforceable due to the subjective nature of the indoor air quality procedures. The original submittal also seemed to require a design for every project. The as-revised version requires specified ventilation rates for specific occupancies within the "05" sections of the Building Code occupancy chapters. These ventilation rates are based on those found in the ventilation rate procedure of American Society of Heating, Refrigerating, and Air-conditioning Engineers (ASHRAE) Standard 62-89 for locations where ambient air quality is adequate to sustain use of the ventilation rate procedure. The as-revised version recognizes the possibility that the ventilation rate procedure may not be appropriate because the ambient air quality is poor, and introduces ASHRAE Standards 62-89, 62a-89 and 52-76 in the U.B.C. Standards as alternatives to the ventilation rate requirements.

(**Staff Note:** *There is some question as to whether the guideline standards referred to in the proposed change comply fully with the policy adopted by the ICBO Board of Directors regarding adoption of standards in March 1990 for these reasons:*

1. The standards are not couched in mandatory language throughout. Because the guideline standards are intended for use by professionally trained design and testing personnel, they contain advisory and explanatory material.

2. The definition of terms employed in the standards differ from those employed in the Uniform Mechanical Code.

3. There are numerous references to supplemental standards.

4. The standards contain appendices which are not part of the standard.)

United States General Accounting Office

GAO

Briefing Report to the Subcommittee on Health and Safety, Committee on Education and Labor, House of Representatives

August 1990

OCCUPATIONAL SAFETY & HEALTH

Options for Improving Safety and Health in the Workplace

GAO/HRD-90-66BR

GAO

United States
General Accounting Office
Washington, D.C. 20548

Human Resources Division

B-235194

August 24, 1990

The Honorable Joseph Gaydos
Chairman, Subcommittee on Health
and Safety
Committee on Education and Labor
House of Representatives

The Honorable Paul Henry
Ranking Minority Member
Subcommittee on Health and Safety
Committee on Education and Labor
House of Representatives

Fatality rates today reflect a safer workplace than when the Occupational Safety and Health Act was passed in 1970. However, on average, at least 13 U.S. workers die each working day from injuries in the workplace, and about another 11,000 are injured seriously enough to lose work time or to experience restricted work activity. Work-related illness is also a substantial problem.

You asked GAO to identify alternative policies or procedures that might better accomplish the act's goal of providing a workplace that is free from safety and health hazards. This report identifies and analyzes options that the Congress and the Occupational Safety and Health Administration (OSHA) could consider for improving the workplace.

To respond to your request, we examined OSHA's current regulatory strategy. We compared OSHA's approach with that of state-operated safety and health programs, as well as the Labor Department's Mine Safety and Health Administration, which protects the nation's miners; we surveyed OSHA inspectors to obtain their views on OSHA's programs. We also interviewed federal and state agency officials, as well as safety and health experts from labor, management, and academia. Finally, we extensively reviewed the published literature on this topic.

OSHA's Regulatory Strategy

OSHA's regulatory strategy emphasizes inspecting worksites for compliance with safety and health standards. In fiscal year 1989, OSHA spent about three-quarters of its $248 million appropriation on standard setting and federal and state enforcement activities.[1] OSHA also encourages employers and workers to improve workplace safety and health conditions and provides education and training to help them do so. For example, inspectors educate employers and workers while doing inspections, and some OSHA standards require employers to provide training to workers.

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[1] OSHA funds up to half the cost of 21 state-operated safety and health programs that it approves and monitors.

Problems Identified

We identified the following problems with improving safety and health in the workplace, given the current legislation, resources, and OSHA strategy:

- OSHA has about 800 inspectors (plus 300 supervisors and trainees) to enforce safety and health standards for almost 3.6 million employers with about 55 million workers.[2] Therefore, even employers in high-hazard, targeted industries are rarely inspected.
- Civil and criminal sanctions used by OSHA provide limited deterrence to employer noncompliance. For example, in fiscal year 1988, the average assessed penalty for a serious violation was $261.
- Some employers have little incentive to "abate" (eliminate) promptly the hazards OSHA inspectors identify. Employers can delay abatement (1) while OSHA obtains a court order to get imminent dangers corrected or (2) by contesting an OSHA citation. In addition, OSHA usually does few follow-up inspections to determine if employers have complied with their agreements to abate hazards. Instead, OSHA relies on employers' verification of abatement, without requiring any evidence that it has taken place.
- Safety and health standards fail to cover existing workplace hazards or keep pace with new ones. For example, estimates of the number of new chemical products manufacturers annually introduce into the workplace range from 1,000 to 3,000—far more than OSHA can regulate with its current approach to standard setting.
- Many employers and workers lack information about workplace hazards. Workers are minimally involved in improving workplace safety and health, and employers often limit their efforts to compliance with standards rather than active attempts to prevent hazards.

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[2] State-operated programs have enforcement responsibility for an additional 2.3 million employers with about 34 million workers.

Options for Improvement

The options we identify in this report might, through either legislative or administrative changes, strengthen the enforcement of standards and the roles of employers and workers (see table 1). Each option has advantages and disadvantages, which we discuss, but we did not analyze the cost-effectiveness of the options. The major factors we considered in selecting options were (1) frequent identification by safety and health experts or in the literature and (2) the extent of evidence we were able to obtain about their feasibility. Using these factors, we excluded from discussion in this report several options we initially considered, including those primarily enhancing existing economic incentives, such as workers' compensation, tort liability, and taxes based on work-related injuries and illnesses.

The options to strengthen OSHA's enforcement strategy would do so by (1) enhancing standard setting, (2) increasing deterrence, and (3) improving hazard-abatement procedures.

Delays in standard setting might be reduced by legislative changes, such as allowing OSHA to use a streamlined rulemaking process to revise the start-up standards set when OSHA was first created. This could be done by using national consensus standards or established federal standards—as the act allowed for the start-up standards. Delays might also be reduced by requiring (1) manufacturers to test likely hazardous substances and (2) OSHA to respond to standard-setting recommendations from groups other than OSHA.

Deterrence might be enhanced by increasing the probability of inspection of hazardous worksites and imposing stricter penalties for violations. Increasing this probability might be accomplished by (1) obtaining better information to target inspections and (2) reducing the amount of time inspectors spend on inspections of less hazardous worksites. Stricter penalties could come from higher civil penalties, expansion and use of criminal sanctions, or loss of the right to participate in federal contract competition.

Abatement options would require employers to (1) abate the identified hazards more quickly—both in imminent danger situations and when employers are contesting the citation—and (2) give OSHA evidence that employers have complied with their agreements to abate hazards.

Options to strengthen the involvement of employers and workers in improving working conditions include (1) strengthening OSHA's education and training efforts, (2) requiring worksite safety and health programs and committees, and (3) increasing worker participation in the inspection process, from the initial inspection through confirming abatement (see table 1).

Table 1: Legislative and Administrative Options Cited That Might Improve Protection of Worker Safety and Health

Option	Legislative	Administrative	Page
Strengthen enforcement			
Standard setting			
Establish an expedited standard-setting process	X		24
Give OSHA authority to require substance testing by manufacturers	X		26
Require OSHA to respond to standard-setting recommendations	X		27
Deterrence			
Obtain better data to target inspections		X	32
Inspect more of the hazardous worksites	X	X	34
Increase civil penalties paid	X	X	35
Expand and use criminal sanctions	X	X	37
Deny federal contracts to noncomplying employers	X	X	38
Hazard abatement			
Give inspectors shutdown authority for imminent dangers	X		40
Protect workers while employers are contesting citations	X		41
Require proof of hazard abatement		X	42
Strengthen roles of employers and workers			
Education and training			
Shift emphasis to programs that train more people		X	45
Employer and worker involvement			
Require safety and health programs		X	46
Require labor-management safety and health committees		X	48
Increase workers' participation in OSHA inspection process	X	X	50

Section 1 includes background material; section 2, an overview of OSHA's regulatory strategy; section 3, the options to strengthen enforcement; and section 4, the options to improve the roles of employers and workers.

Agency Comments

Labor said that GAO has suggested a number of interesting administrative and legislative solutions to the problems outlined in this report. Labor did not comment on the specific options identified, but noted that the administrative options will be seriously considered. Labor also suggested some clarifications concerning OSHA's (1) regulatory strategy, (2) efforts to increase the deterrent impact of its inspections, and (3) efforts to seek voluntary cooperation between employers and workers to improve workplace safety and health. We have made the necessary changes to reflect Labor's concerns. Labor's letter is shown in appendix IV.

As you requested, no further distribution of this report will be made for 14 days or until you release it. At that time, we will send copies to the Secretary of Labor and other interested parties. Should you have any questions or wish to discuss the information provided, please call me on (202) 275-1793. Other major contributors to this report are listed in appendix V.

Franklin Frazier

Franklin Frazier
Director, Education and
Employment Issues

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Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
BLS	Bureau of Labor Statistics
EPA	Environmental Protection Agency
LWDI	lost workday injury
MSDS	material safety data sheet
MSHA	Mine Safety and Health Administration
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
OSHRC	Occupational Safety and Health Review Commission

Section 1

Introduction

Background

The Congress enacted the Occupational Safety and Health Act of 1970 on December 29, 1970, with the sweeping goal of "assuring so far as possible every working man and woman in the Nation safe and healthful working conditions." The act marked the first comprehensive, nationwide regulatory program to prevent workplace injuries and illnesses.

Earlier acts, both federal and state, had focused primarily on compensation to workers for workplace injuries. However, it had become apparent that workers' compensation, tort liability, and the tax system had failed to provide adequate incentives for employers to "abate" (eliminate) workplace hazards voluntarily. A 1970 Senate report ranked the problem of ensuring safe and healthful worksites for workers as of equal importance with any that engaged the national attention at that time.[1] In 1968, the Secretary of Labor testified that yearly, because of safety and health problems at the workplace, about 14,500 workers would be killed,[2] over 2 million disabled, and over 7 million injured. In 1970, he also testified that the number of disabling injuries per million hours worked was 20 percent higher in 1970 than in 1958.[3]

The act requires employers in the private sector to (1) furnish employment and a place of employment that are free from recognized hazards that cause or are likely to cause serious physical harm or death to workers and (2) comply with occupational safety and health standards. The act also requires each worker to comply with occupational safety and health standards, as well as all rules, regulations, and orders issued under the act that are applicable to the worker's own action and conduct.

As shown in figure 1.1, the act covers about 88.7 million workers and about 5.9 million employers. Only three groups were excluded from direct coverage: the self-employed, those employed by state and local governments,[4] and those covered under other federal safety and health laws. The last group now includes miners, as well as airline and nuclear facilities workers. Since 1976, an appropriations rider has exempted certain small farms with 10 or fewer workers. Each federal agency must

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[1] S. Rept. 1282, 91st Cong., 2d Sess. (1970).

[2] Hearings on S.2864 before the Subcommittee on Labor, Senate Committee on Labor and Public Welfare, 90th Cong., 2d Sess. 69,71-73 (1968).

[3] S. Rept. 1282, 91st Cong., 2d Sess. (1970).

[4] State and local government employees are, in some states, covered by state-operated safety and health programs approved by OSHA.

Figure 1.1

GAO

The Occupational Safety and Health Act of 1970

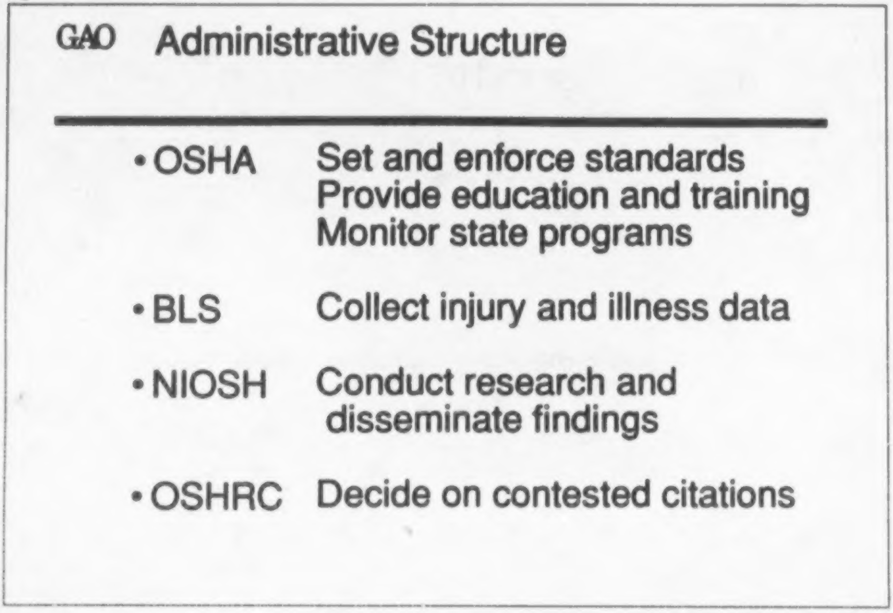
Purpose: To ensure safe and healthful work conditions

Coverage: 5.9 million employers
88.7 million workers

Excluded: Self-employed
State and local government employees
Workers covered by other legislation

establish and maintain an effective and comprehensive safety and health program for the protection of federal workers; the program must be consistent with OSHA standards for private sector employers.

Figure 1.2



GAO Administrative Structure

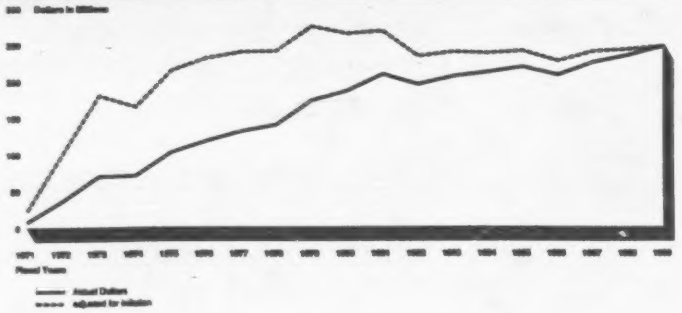
• OSHA	Set and enforce standards Provide education and training Monitor state programs
• BLS	Collect injury and illness data
• NIOSH	Conduct research and disseminate findings
• OSHRC	Decide on contested citations

Administrative Structure

The act separated enforcement-related activities on occupational safety and health from research activities. The Department of Labor is to carry out enforcement activities through the Occupational Safety and Health Administration (OSHA) and the Bureau of Labor Statistics (BLS); the Department of Health and Human Services is to carry out research activities through the National Institute for Occupational Safety and Health (NIOSH). In addition, the act established the Occupational Safety and Health Review Commission (OSHRC). (See fig. 1.2.)

Figure 1.3

GAO OSHA Budget Authorizations (1971 - 89)



Note: Inflation adjustments used the GNP deflator for total federal expenditures on goods and services with 1989 as the base year. Thus inflation adjustment figures are in 1989 dollars.

Occupational Safety and Health Administration

The Secretary of Labor established OSHA to administer the act. OSHA sets mandatory safety and health standards; through its regional, area, and district offices, OSHA inspects private sector worksites, proposes penalties, and prescribes abatement dates for employers found violating the standards or failing to meet their "general duty" to provide a workplace that is free from safety and health hazards. In addition, OSHA provides education to workers, employers, and the public, mostly through grant activities.

The act authorizes the states to develop and operate their own safety and health programs; 21 states and 2 territories do so.[5] OSHA approves, monitors, and evaluates these state programs. It may fund up to 50 percent of the cost of operating these programs.

OSHA's budget authorization in actual and constant (inflation-adjusted) dollars for fiscal years 1971 through 1989 is shown in figure 1.3. In fiscal year 1989, OSHA's budget authorization was $248 million. Although OSHA's funding has increased since 1971, funding, adjusted for inflation, has remained steady since 1982, decreasing about 10 percent since its peak in 1979. Meanwhile, data provided to us by OSHA showed that the number of employers covered by OSHA increased over 30 percent between 1979 and 1989.

Bureau of Labor Statistics

BLS is responsible for collecting occupational safety and health data. It issues guidelines to employers, defining what injuries and illnesses to record and what information to record about them. In addition, BLS (1) surveys some 280,000 employers annually to obtain occupational injury and illness data and (2) provides the statistical results to OSHA and others. For fiscal year 1989, about $20 million of OSHA's $248 million budget went to BLS.

National Institute for Occupational Safety and Health

The act created NIOSH within the Department of Health and Human Services. NIOSH is responsible for conducting research and analyzing the results so as to prevent illness and control hazards in the workplace. NIOSH's mandate includes four basic tasks: respond to requests for investigations of workplace hazards, conduct research on ways to control or prevent work-related health and safety problems, recommend to OSHA appropriate regulatory actions ("standards") based on scientific findings, and train occupational safety and health professionals to carry out the mandates of the act. NIOSH also does work for other agencies, including the Mine Safety and Health Administration (MSHA) and the Environmental Protection Agency (EPA).

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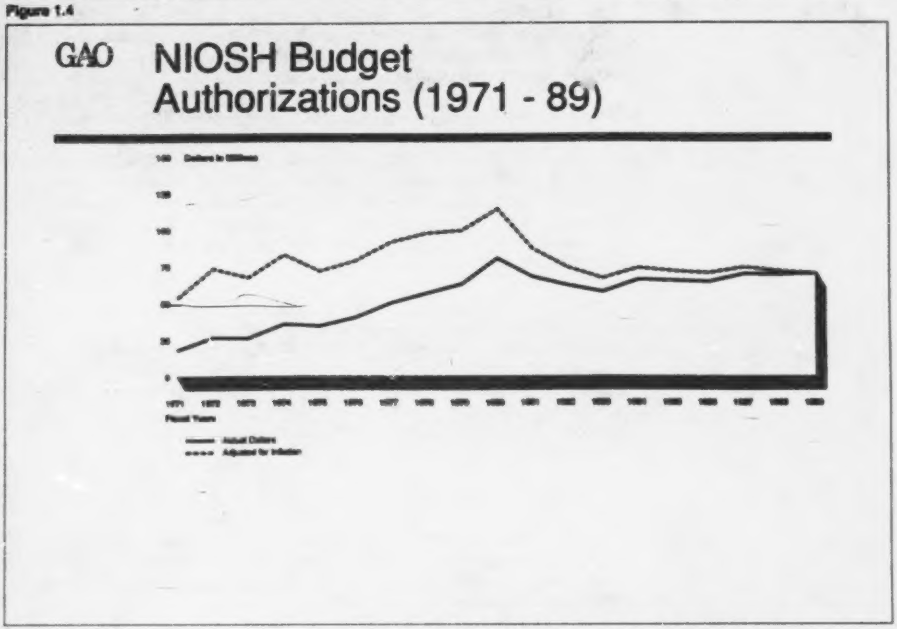
[5] These programs are required to provide enforcement in the public sector (state and local government employees) as well as the private sector. Two additional state-operated programs provide enforcement coverage in the public sector only, with OSHA responsible for private sector enforcement.

Figure 1.4



Note: Inflation adjustments used the GNP deflator for total federal expenditures on goods and services with 1989 as the base year. Thus inflation adjustment figures are in 1989 dollars.

NIOSH's budget authorization in actual and constant dollars for fiscal years 1971 through 1989 is shown in figure 1.4. For 1987-89, NIOSH's budget authorization had been about $70 million annually. Like those of OSHA, NIOSH's budget authorizations adjusted for inflation have remained steady since 1982. However, the 38-percent decrease, since its peak year of funding in 1980, has been greater than OSHA's decrease. NIOSH's funding level is lower now, in real terms, than in 1972.

Occupational Safety and Health Review Commission

Employers may appeal a citation or proposed penalty to OSHRC, which has three members appointed by the President, with the advice and consent of the Senate, for staggered terms of 6 years. OSHRC employs administrative law judges to rule on contested cases. On the basis of evidence provided at hearings, the judges decide whether to affirm, "vacate" (annul), or modify OSHA's citation and proposed penalties. After the decision, any party can petition OSHRC to review the decision of the administrative law judges.

Legislation Has Not Been Substantially Amended

Except for a minor technical change, the act has not been amended. However, the Congress has enacted various appropriations riders, generally limiting the worksites at which OSHA could enforce the act's provisions. Six appropriations riders were in effect in fiscal year 1989. For example, OSHA cannot use appropriations to (1) apply the act's provisions to farms that have 10 or fewer workers and do not maintain a temporary labor camp or (2) schedule routine safety inspections of certain employers with 10 or fewer workers.

Trends in Work-Related Injuries and Illnesses

Occupational injury data suggest that workplace fatalities have decreased since implementation of the act, even though employment has substantially increased. Estimates differ, however, on the number of fatalities. For example, BLS reported that in 1988 there were 3,300 fatalities—down from 4,970 in 1974. In contrast, the National Safety Council reported 10,600 fatalities for 1988—down from 13,800 in 1970. One reason for the difference is that BLS, in its calculations, only includes fatalities in worksites with 11 or more workers and excludes public sector employers and the self-employed. Using the BLS estimates as a lower bound, we estimate that for employers with 11 or more workers, there were at least 13 workplace injury fatalities for each working day in 1988.

No reliable data are available about trends in fatalities because of work-related illness. According to a 1985 Office of Technology Assessment report,[4] the most commonly quoted annual estimate for workplace deaths because of illness is 100,000. However, according to the report, others have cited estimates ranging from 10,000 to 210,000 deaths. More accurate estimates are difficult to obtain for several reasons. First, there is a general lack of information on both past and current worker exposures. Second, the deleterious effects of workplace exposures are not always known. Finally, multiple factors may exist that make it impossible to assign a single "cause" to a disease.

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[4] Preventing Illness and Injury in the Workplace, U.S. Congress, Office of Technology Assessment, OTA-H-256 (Washington, D.C., Apr. 1985).

Although fatalities because of workplace injuries have decreased, the number of workdays lost because of injuries—a measure of injury severity—has significantly increased. The average number of lost workdays per 100 full-time workers rose from 54.6 in 1974 to 76.1 in 1988. In 1988, about 11,000 workers were injured seriously enough each day to lose work time or to be put on restricted work activities. A total of 56.9 million workdays were lost as a result of work-related injury or illness in 1988.

OSHA's impact on injury and illness rates is largely unknown. Injury and illness rates are affected by a number of factors. These include the effects of the business cycle; various changes in the administration of workers' compensation; other socioeconomic factors, such as a shift from a manufacturing (high-risk) to a service (low-risk) economy; and OSHA. The Office of Technology Assessment report concluded

> "There is a general belief that the presence of OSHA has increased manager and worker awareness of occupational health and safety. This increased attention has also created a need for health and safety professionals and probably increased their role in company decisionmaking. The presence of a Federal regulatory agency may lead employers to anticipate potential health and safety problems and solve them before regulatory action becomes necessary. The OSH Act also created new rights for worker information and participation concerning health and safety."[7]

Objective, Scope, and Methodology

The Chairman and the Ranking Minority Member of the Subcommittee on Health and Safety, House Committee on Education and Labor, asked GAO to conduct a broad review that would identify ways in which worker safety and health might be better ensured in this country. The request encompassed administrative changes that could be made at OSHA, as well as possible changes to the legislation.

We collected information on how federal programs protect workers from occupational safety and health hazards, the perceived problems with such approaches, and options for improvement. The areas we examined were (1) setting and enforcing safety and health standards, (2) providing education and training, (3) collecting injury and illness data, (4) evaluating program effectiveness, and (5) conducting safety and health research. In our review, we considered the roles of administrative agencies, employers, and workers.

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[7] Preventing Illness and Injury in the Workplace, p. 264.

We collected information through (1) interviews with federal and state program administrators as well as safety and health experts from labor, management, and academia; (2) a mail questionnaire to a random sample of OSHA safety and health compliance officers and to all supervisors;[a] (3) a literature review; (4) agency procedures and performance data, where applicable; and (5) recent legislative initiatives to improve worker safety and health introduced in the 99th, 100th, and 101st Congress.

We also identified different and additional program elements administered by states with OSHA-approved state programs and MSHA. For three state programs, we obtained performance data, when available, on approaches that OSHA did not use or that were different from the federal program.

We did our review between July 1988 and October 1989. In September 1989, we briefed OSHA officials about the problems we identified concerning the OSHA program and the options contained in this report.

The data (inspection and penalty statistics) we obtained from OSHA's management information system are unverified, except to the extent that we made consistency checks and received assurances about validity of data from OSHA officials. In all other aspects, our work was carried out in accordance with generally accepted government auditing standards.

Further detail on the methodology we used is provided in appendix I.

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[a] In the report, we use the term inspectors to refer to the combination of compliance officers and supervisors whose responses we describe.

Section 2

OSHA's Regulatory Strategy

OSHA has broad discretion to decide which strategy or strategies to employ and the level of resources to allocate to its various programs. Nevertheless, the act places emphasis on setting and enforcing standards as a means to bring about a workplace free from safety and health hazards. The act also provides for other OSHA and private activities. These activities included agency education and training designed to acquaint the public with (1) workplace hazards, (2) means of abatement, and (3) voluntary efforts—by individuals, groups, and the private sector—to reduce injury and illness in the workplace.

OSHA defines its strategy as largely relying on voluntary compliance by employers and workers. OSHA noted that, ideally, enforcement actions, with appropriate citations and penalties, should be necessary only when employers fail—for whatever reason—to consider safety and health as an integral part of their responsibilities to workers. Consequently, OSHA combines enforcement with educational and assistance efforts. The agency promotes training and education through formal training and assistance programs, training requirements in many OSHA standards, and other agency activities. For example, inspectors are expected to educate employers and workers as part of their inspection activities.

OSHA's allocation of resources to implement its strategy is shown in figure 2.1. Of the $248 million OSHA budgeted in fiscal year 1989, about 47 percent went to federal enforcement activities; another 18 percent went to state enforcement activities;[1] and about 3 percent went to standard setting. Compliance assistance—which includes education, training, and consultation—was the other major area, making up about 14 percent of the budget.

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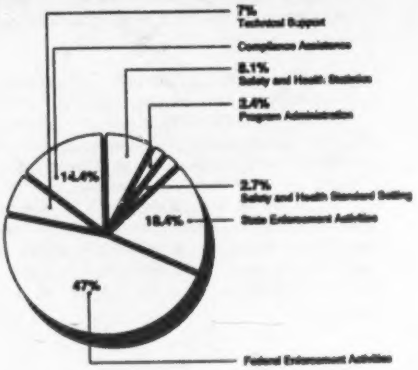
[1] OSHA funds up to half the cost of state-operated safety and health programs.

Figure 2.1

GAO OSHA Budget by Function (Fiscal Year 1989)



Note: Technical support activities support both standard setting and enforcement activities.

Enforcement Activities

OSHA's enforcement strategy relies on inspecting worksites; citing employers for noncompliance with OSHA standards and the act's general duty clause, which requires employers to provide each employee with employment and a workplace that is free from recognized hazards that cause or are likely to cause serious physical harm or death; and verifying that employers have abated hazardous conditions. This strategy is characterized by inspection of high-hazard industries; response to formal worker complaints; pursuit of civil penalties; the reduction of fines for prompt abatement; and reliance on employers' assurance that abatement took place. (These procedures are described in more detail in app. II.)

OSHA's enforcement procedures are intended to bring about safe and healthful working conditions in two significant ways. First, OSHA's unannounced workplace inspections and fines are intended to provide an incentive for employers to correct hazards before being inspected. Second, OSHA tries to get employers to abate hazards that have been identified through inspections. The agency issues abatement orders, conducts follow-up inspections, and imposes daily penalties for failure to abate.

In setting the standards to be enforced, OSHA's current standard-setting strategy emphasizes setting performance-based and generic standards. Performance-based standards regulate end results rather than describe physical characteristics needed to meet a standard. For example, a performance-based standard would specify that a ladder should support a certain amount of weight rather than specifying the material of which it should be made. Generic standards regulate multiple problems in single industries or regulate work practices and procedures affecting many industries, rather than addressing only a single hazard. The hazard communication standard is an example of a generic standard providing information to employers and workers on hazardous chemicals.

Roles of Employers and Workers

The Occupational Safety and Health Act contains roles for both employers and workers. Both are expected to be knowledgeable about OSHA standards and regulations so that hazardous workplace conditions are identified and corrected. Employers are also expected to provide a workplace that is free from safety and health hazards; workers are expected to comply with safety and health procedures to protect themselves and other workers. Workers may also report to OSHA any unsafe and hazardous work practices.

OSHA's primary way of helping employers and workers carry out these roles is through education and training, which is provided in two ways: (1) agency-funded activities and (2) employer-funded activities (see app. III). Agency-funded training activities include workplace consultation visits at the request of employers, grants to worker and employer associations for safety and health training, and such training at the OSHA

Training Institute. In addition, more than 100 OSHA standards and guidelines mandate or recommend minimum levels of training employers should provide.

Data Collection and Evaluation

OSHA's overall strategy also includes acquiring an information base with both (1) data on work-related injuries and illnesses and (2) evaluative information on how well OSHA policies, procedures, and programs are functioning. The importance of injury and illness data was emphasized by the act's requiring that (1) employers record injury and illness information and (2) the Department of Labor establish a system to collect such data. Labor's strategy for obtaining injury and illness data is to (1) rely primarily on survey data collected by BLS and (2) supplement these data with other data, such as the results of NIOSH's monitoring activities. OSHA has an evaluation system that is intended to help it monitor—through a combination of internal studies and studies obtained from outside sources under contracts—the effectiveness of its various programs and policies.

Although we examined the problems and options available for strengthening data collection and program evaluation, the only such option we present in this report is strengthening inspection targeting by obtaining better injury and illness data (option 4, discussed in sec. 3). OSHA and BLS, recognizing their data problems, are already exploring ways to make other improvements in data collection, for example, expanding the injury and illness data employers will record and report. Alternative approaches were pilot tested in fiscal year 1989; BLS will start using the approach selected in 1991, and complete implementation is expected by 1993.

We noted that OSHA conducts few evaluation studies. Many important questions about how well programs and policies work are going unanswered. For example, it would be useful to test the utility of some of the approaches used by state-operated programs but not by OSHA—approaches such as (1) using workers' compensation data to target inspections; (2) inspecting after all accidents, not just accidents resulting in a fatality or hospitalization of five or more workers; and (3) requiring employers to have safety and health programs. Nevertheless, we recognize that an agency has to weigh the costs of such studies against other priorities.

Section 3

Strengthening Enforcement

OSHA's enforcement activities could be improved by enhancing the standard-setting process so as to regulate more hazards, increase deterrence, and facilitate hazard abatement.

Enhance Standard Setting

Examples of Problems With Standard Setting

OSHA standards fail to (1) cover many health and safety hazards adequately and (2) keep pace with knowledge about new or existing hazards. In the health area, estimates of the number of new chemical products introduced into the workplace range from 1,000 to 3,000 a year.[1] In comparison, as of 1989, OSHA standards regulated only about 630 substances, most of which are accounted for by a single air contaminants standard. This standard specifies permissible exposure levels, but does not include other features, such as exposure monitoring, medical surveillance, and removal. Fewer than 30 substances hazardous to health are regulated by more comprehensive standards. Many of the safety standards initially set are outdated or fail to address important workplace hazards. For example, a presidential task force in 1976 estimated that the standards governing machine guards that OSHA had adopted in 1971 covered only 15 percent of the machine types then in use. As of 1989, these standards had not been updated.

Agency officials and outside experts have identified excessive delays in standards promulgation as a major cause of the gap in coverage by standards. As of May 1988, 14 of the 27 standards OSHA had in process through the basic rulemaking procedure (see fig. 3.1) had been under development for over 4 years. Some examples of delayed individual substance standards include those regulating butadiene, cadmium, and methylene chloride. Standards for all three substances remained in the preproposal stage as of December 1989, despite 2 to 4 years having passed since OSHA announced its intention to begin work on these standards and put them on its regulatory agenda.

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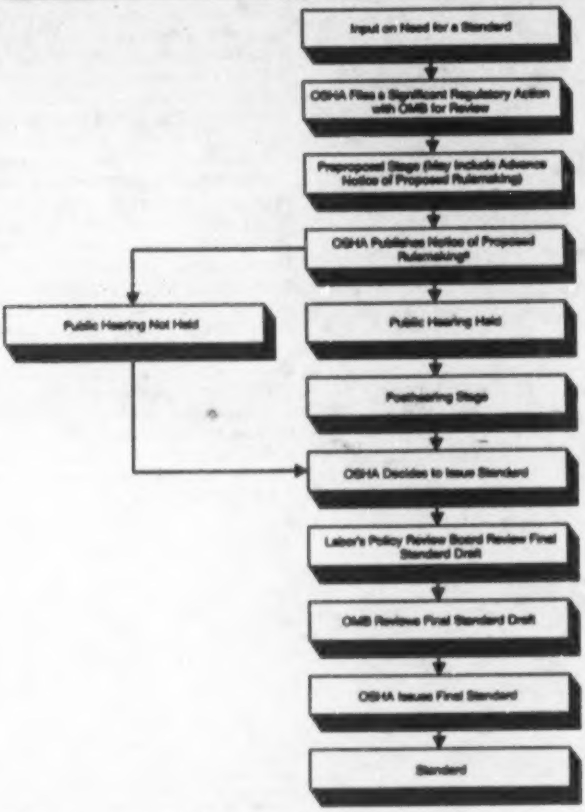
[1] House Committee on Science and Technology, Neurotoxins at Home and in the Workplace, 99th Cong., 2d Sess., 1986, H. Doc. 99-827.

Figure 3.1: OSHA 6(B) Standard-Setting Process


Input on Need for a Standard
OSHA Files a Significant Regulatory Action with OMB for Review
Preproposal Stage (May Include Advance Notice of Proposed Rulemaking)
OSHA Publishes Notice of Proposed Rulemaking[a]
Public Hearing Not Held
Public Hearing Held
Posthearing Stage
OSHA Decides to Issue Standard
Labor's Policy Review Board Review Final Standard Draft
OMB Reviews Final Standard Draft
OSHA Issues Final Standard
Standard

[a] During this stage, Labor's Policy Review Board and OMB review the proposed standard draft.

Some standards regulating serious hazards were in process almost a decade before completion. For example, OSHA issued a final lockout or "tagout" standard, governing the sudden activation of machinery, in September 1989, after the standard had been in process since June 1980.[2] (In our questionnaire, OSHA inspectors had cited a lockout situation as second in importance only to "confined space" as a hazard unregulated, at that time, by a specified standard.)

The time required to promulgate standards is a problem not only with setting standards using the basic rulemaking procedure but also with revising initial start-up health and safety standards that were established under section 6(a) of the act. This section allowed OSHA to adopt, without additional rulemaking, those standards established by other federal agencies or adopted by national consensus.[3] Under current law, OSHA can only revise these consensus standards through its regular section 6(b) rulemaking process (see fig. 3.1), even if the proposed revisions are relatively noncontroversial and widely accepted.

Options for Enhancing Standard Setting

There is no single answer to OSHA's standards-setting difficulties. Increasing staff and funding for standard setting would probably increase the number of standards. However, OSHA estimates suggest that additional resources alone may not be sufficient. Three legislative options, including their advantages and disadvantages, are discussed below (see fig. 3.2).

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[2] This standard requires either (1) lockout, locks on machines to prevent their being accidentally energized or activated, or (2) tagout, tags warning of machine hazards when this warning would provide the same degree of workplace protection as a lockout.

[3] Most of these start-up standards were safety standards issued by organizations such as the American National Standards Institute. In addition, these start-up standards established permissible exposure levels for about 400 substances by using the threshold limit values set by the American Conference of Governmental Industrial Hygienists.

Figure 3.2

GAO

Options to Reduce Delay in Standard Setting

- Establish an expedited process to revise start-up standards
- Give OSHA independent authority to require substance testing by manufacturers
- Require OSHA to act on new information and explain its decisions

Option 1: Establish an Expedited Standard-Setting Process for Revision of Start-Up Standards

The Congress could amend the act to permit the agency to use an expedited process to revise the section 6(a) start-up standards. Such a procedure would enable OSHA to (1) provide workers with updated protection from hazardous substances that may be relatively noncontroversial but now lack adequate coverage and (2) keep existing standards current with scientific and technological advances.

Several proposals would allow OSHA to develop more readily proposed revisions to the start-up standards. For example, the Administrative Conference of the United States has recommended the use of outside, nongovernmental consensus standards for some hazards.[4] In the health area, these consensus standards could be the threshold limit values established by the American Conference of Governmental Industrial Hygienists (ACGIH), NIOSH recommendations, or some combination of these and other organization guidelines. Such an expedited process would be restricted to the revision of the permissible exposure levels.

Alternatively, OSHA could set up a special unit whose purpose would be to gather information in order to revise existing exposure limits. Every 2 or 3 years, this unit would propose revisions, based on the consensus it identified in the scientific literature, to the exposure limits. OSHA could internally evaluate this list of proposed revisions to permissible exposure levels and use public hearings to obtain additional information.

After OSHA had developed the proposed revisions, the Congress could allow OSHA to use a streamlined rulemaking process, outside of the regular 6(b) procedure, to make the revisions. To revise the start-up standards, the Congress, for example, could allow OSHA to use the same section 6(a) authority again or the Congress could allow OSHA to use modified 6(b) procedures, such as an abbreviated notice and comment period for public input or more strictly circumscribed public rights.

Even though the revisions themselves might be limited in scope, OSHA would still have the option to propose complementing standards covering medical surveillance, exposure, or other issues. This would be consistent with the act's approach of initially establishing a minimum level of protection for workers, to be followed with more comprehensive regulation. However, critics point out that a focus on revising the permissible exposure levels may reduce the pressure on OSHA to secure more comprehensive protection.

Perhaps the most difficult issue to resolve in carrying out an expedited process would be the choice of the consensus standards OSHA would use as the basis for revision. In the health area, OSHA used the threshold limit value guidelines issued by ACGIH in revising the 1989 air contaminants standard. Yet, some observers have criticized those guidelines as poorly supported by scientific evidence. On the other hand, using NIOSH recommendations may pose other problems. In making recommendations, NIOSH is not required to consider such factors as the feasibility of implementation, which OSHA would have to consider in revising the standards; thus, additional work may be needed to modify NIOSH recommendations for use in operational standards.

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[4] T.O. McGarity and S.A. Shapiro, OSHA Regulation: Regulatory Alternatives and Legislative Reform, Administrative Conference of the United States (Sept. 1987), p.1101.

Having OSHA develop its own consensus standards from reviews of the literature and other available information may avoid some of these difficulties, but that approach may be unacceptable to employers and workers. The procedure OSHA would use to determine what hazardous substances it will update and their level of regulation would have to be persuasive to encourage participation by employers and workers and avoid litigation.

Further, recent agency success in its 1988-89 efforts to revise the start-up standards on air contaminants raises the question of whether an expedited process is necessary. OSHA used the regular 6(b) rulemaking process and the 1987-88 ACGIH threshold limit value guidelines to revise the permissible exposure levels. The agency completed the project in about 18 months, a short time compared with other OSHA health standards. However, it is unclear whether that success was an aberration or a demonstration of the agency's ability to revise standards quickly. It appears to have been accomplished, in part, by diverting a substantial portion of the program funds that would otherwise have been used for evaluation and other activities. Moreover, interested parties are challenging the standard in the courts where, as of April 12, 1990, it faced a total of 17 lawsuits.

Option 2: Give OSHA Independent Authority to Require Substance Testing by Manufacturers

The Congress could provide OSHA with limited authority to require data collection and testing by manufacturers of hazardous substances, that is, chemicals and air contaminants.[3] OSHA could function more effectively if it had better data, particularly about the risks posed by chemicals. However, epidemiological and animal test data have been published for only a limited number of the thousands of chemicals found in the workplace. In addition, most testing of chemicals that are candidates for regulation is done outside of the government—by university researchers, commercial laboratories, or manufacturers themselves—and OSHA must await the results. If OSHA was able to require manufacturers to test substances slated for regulatory action, the agency would most likely have better data on which to base standards and could improve its regulatory performance.

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[3] The Congress did something similar under the Toxic Substances Control Act. EPA has authority under the act to order anyone who manufactures or processes a chemical to test it under certain conditions. The act established the Interagency Testing Committee, with representatives from eight agencies, including OSHA, to make recommendations to EPA concerning which chemicals should be tested. The committee compiles a list of recommended chemicals for EPA to require testing by manufacturers.

However, requiring manufacturers to perform tests could result in duplication of NIOSH's research activities. The relationship of NIOSH and OSHA in determining the list of substances to be tested and the type of testing to be done would have to be specified.

Option 3: Require OSHA to Act on New Information and Explain Its Decisions

OSHA could be held accountable for responding promptly to outside requests for standard-setting actions. OSHA receives periodic recommendations from several sources about the need for standard-setting activity. For example, NIOSH recommends (1) exposure limits for potentially hazardous substances or conditions in the workplace and (2) preventive measures designed to reduce or eliminate the adverse health effects of these hazards. OSHA's own standing advisory committees on specific topics also provide the agency with recommendations.

OSHA is not required to respond or make public comment on recommendations from NIOSH or its standing advisory committees, but OSHA is required to respond to certain chemical referrals from EPA. Under section 9(a) of the Toxic Substances Control Act, EPA may refer to other agencies, including OSHA, a chemical that EPA believes poses an "unreasonable risk." For example, EPA would request that OSHA determine whether a chemical substance poses a risk to workers and whether a rulemaking action by OSHA would sufficiently reduce the risk.

Under section 9(d) of the act, EPA can also refer substances to OSHA when EPA has determined that a substance is a workplace hazard, but has not found "unreasonable risk."[6]

OSHA has considered that issuing an Advanced Notice of Proposed Rulemaking meets the legislative requirements to respond, and EPA has accepted this position. Even providing this response, however, has not come quickly. For example, OSHA took 6 months to agree with EPA that OSHA has authority to regulate butadiene and that the substance poses an unreasonable risk; it took an additional 6 months to issue the advanced notice. OSHA took similar amounts of time to respond to an EPA referral on glycol ethers.

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[6] During the last 8 years, EPA has referred the following to OSHA: three substances under section 9(a) and four under section 9(d).

To facilitate greater agency accountability and the use of existing information as well as public input, the Congress could require OSHA to list NIOSH recommendations and EPA referrals in its regulatory agenda along with OSHA's proposed plan of action on each. As for advisory committees, OSHA could publish committees' recommendations for public comment. At the close of the comment period, OSHA could summarize and give its own views within a specified period of time. However, this option could result in OSHA's overextending its resources as it attempts to respond to each item.

Increase Deterrence

Problems With Deterrence

The deterrent effect of OSHA enforcement efforts has been a problem for at least two reasons. First, because of limited resources, OSHA inspects most employers rarely, if at all. Second, sanctions for noncompliance are weak. Civil penalties, on the whole, have been low, particularly when compared with the cost of abatement. The available criminal sanctions are limited and rarely result in a conviction.

Infrequent Inspections

In fiscal year 1989, we estimate that OSHA had about 800 compliance officers (not including about 300 supervisors and trainees) to inspect almost 3.6 million employers and about 55 million workers. State-operated safety and health programs had an authorized staffing level of about 1,050 inspectors covering 2.3 million employers with an estimated 34 million workers. According to our questionnaire data, inspectors averaged 72 inspections in fiscal year 1988. Safety compliance officers averaged 102 inspections, and health compliance officers averaged 32 inspections.

OSHA tries to target scheduled inspections to worksites thought likely to be hazardous but, in fact, conducts relatively few inspections in high-hazard worksites. For example, in fiscal year 1989, only 10 percent of the worksites OSHA identified as high hazard for safety reasons were inspected. Similarly, only 3 percent of the worksites identified as high hazard for health reasons were inspected. Of these inspections, about half were conducted in response to specific evidence of hazardous conditions at a worksite, such as complaints or referrals.

In addition, OSHA's inspection targeting procedures are hampered by data limitations in each of three major targeted ("programmed") inspection categories: safety inspections in high-hazard manufacturing industries, safety inspections in the construction industry, and health inspections in high-hazard industries.[7] For example, OSHA targets safety inspections outside the construction industry on the basis of manufacturing industries' average lost workday injury (LWDI) rates, as found in the BLS annual occupational safety and health survey.[8] But using BLS annual survey data has several shortcomings, including employers' underreporting, time lags between collection and availability of data, and lack of OSHA access to "establishment-level" (employer) survey data.[9]

As OSHA pointed out in its comments on this report, it has recently taken several steps to extend its impact beyond the inspection of individual worksites. In 13 instances, OSHA has been able to get the employer to agree not only to correct violations found on the OSHA inspection, but also to make similar corrections in other plants owned by the employer where the same violative conditions exist. Moreover, in two instances, OSHA used review of records at corporate headquarters to identify violations without having to visit the separate worksites of the individual company. If used more extensively, these strategies could significantly increase the impact of OSHA's inspections.

Limited Penalties

Even when worksites are inspected, the penalties have less impact than originally intended. OSHA's penalties have gone unchanged since the act was enacted in 1970. The maximum fines range from $1,000 for a nonserious violation to $10,000 for willful and repeat violations. About 76 percent of the OSHA inspectors we surveyed believed that the civil fines allowed by the act should be increased to provide a stronger deterrent effect.

OSHA has sometimes levied substantially higher penalties than the maximum by citing employers on an instance-by-instance approach. With this approach, employers who are "egregiously" violating OSHA standards are cited for every instance of a standard violated, rather than being assessed one penalty for a certain type of violation, such as recordkeeping. Consequently, the assessed fines can be substantially larger than the maximum $10,000. However, OSHA has used this approach sparingly—about 100 times—and an individual instance, no matter how severe, is still limited by the act. The majority of the OSHA inspectors we surveyed (61 percent) said this approach should be used more often, and 46 percent believed that such penalties have a significant effect on other employers' compliance with OSHA requirements.

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[7] Targeting procedures for firms in low-hazard manufacturing and nonmanufacturing industries are based on random selection, but these procedures account for few inspections. Most of OSHA's programmed inspections are safety inspections done in construction or manufacturing industries.

[8] An LWDI rate is the average number of injuries that required days away from work or restricted work activity per 100 full-time workers per year.

[9] For example, a study done for GAO compared fiscal years 1985, 1986, and 1987 OSHA inspection results for over 2,700 inspections with the LWDI rates those employers reported to BLS. It was found that the number of serious violations per inspection was more closely related to an employer's LWDI rate than to whether the employer was in a low-hazard or high-hazard industry.

OSHA policies for initially proposing and, in many cases, subsequently reducing fines further limit any deterrent effect. For example, although violations classified as "serious" by OSHA carry a maximum fine of $1,000, the average assessed penalty per serious violation was $261 in fiscal year 1988. This occurs, in part, because the initial fine proposed may be as much as 80 percent less than the maximum depending on the employer's (1) size of company (fine can be reduced up to 40 percent); (2) good faith (30 percent), which usually means the employer has already abated or promises to abate the hazard quickly; and (3) history of previous violations (10 percent). In addition, OSHA area office directors are authorized to further reduce the proposed fine as a result of informal discussions with an employer.

Limited Criminal Sanctions

OSHA has the authority to refer certain violations to the Department of Justice for criminal prosecution. However, successful criminal prosecution has been very limited. The act only allows criminal penalties if (1) an employer willfully violates OSHA regulations, resulting in a worker's death, or knowingly makes false representation or (2) a person knowingly tells an employer that an inspection is scheduled.

In the use of criminal sanctions, OSHA has referred 57 cases to the Department of Justice since 1970—22 of them since 1986. Of the 57 cases, 14 cases (25 percent) resulted in convictions. In over half of the cases, the Department of Justice declined to prosecute.

Options to Increase Deterrence

We believe that the options we describe may increase the deterrent effect of OSHA's enforcement program (see fig. 3.3). These options have possible advantages and disadvantages, including added costs to OSHA or employers or both. We grouped these options into those that increase

Figure 3.3

GAO Options to Increase Deterrence

- Obtain better information to target inspections
- Inspect more of the hazardous worksites
- Increase size of civil penalties
- Expand criminal sanctions
- Bar violators from federal contracts

the probability of inspecting hazardous worksites and those that would impose stricter penalties for violations. Increasing inspections of the more hazardous worksites might be accomplished by (1) obtaining better information to target inspections and (2) reducing the amount of time inspectors spend on inspections when there are no serious violations. Stricter penalties could come from higher civil penalties, expansion and use of criminal sanctions, or loss of the right to participate in federal contract competition.

Option 4: Obtain Better Information to Target Inspections

The information OSHA might use to better target programmed inspections could come either from (1) requiring employers to report data they are already required to record at worksites or (2) using other data sets that already exist or could be created.

Option 4a: Require Certain Employers to Report Injury and Illness Data to OSHA

Labor could require certain employers to report injuries and illnesses directly to OSHA, regardless of whether these employers report to BLS as part of the annual survey sample. Direct reporting of these data, which OSHA already requires employers to record at their worksites, could provide systematic detailed data, thereby improving the use of inspection resources. One approach would be to require such reporting of all employers in high-hazard industries. A second approach would require this for all employers, regardless of industry, that have injuries and illnesses above certain levels. The effectiveness of OSHA's targeting program may, thus, be enhanced by targeting programmed inspections using an individual employer's injury rate. In addition, OSHA could focus its enforcement, as well as education and training efforts, on employers with high injury and illness rates in industries known to be hazardous.

Direct reporting should place no additional recordkeeping burden on employers. This is because employers are already required to record information on every work-related injury and illness, even though no employers are required to report this information to OSHA and most employers are not required to report it to BLS. When dual reporting to OSHA and BLS would occur, the employer could send the data to OSHA, which would, in turn, send it to BLS.

The major disadvantages in the first approach are (1) some employers might be encouraged to underreport injuries and illnesses, (2) OSHA would still lack information about establishments with high injury and illness rates that are not in high-hazard industries, and (3) additional OSHA resources would be required to analyze the data.

In the second approach, OSHA could focus its enforcement, as well as education and training activities, on all employers with high injury and illness rates. A major advantage of this approach is that all establishments with high injury and illness rates would be required to report and none would be overlooked. However, this approach would constitute an even higher incentive than the first approach for employers to underreport injuries and illnesses.

Option 4b: More Fully Use Other Data

OSHA could explore the availability and potential use of other data to help identify the most hazardous worksites to inspect. These data include (1) workers' compensation records, (2) accident reports, (3) construction permits, and (4) notices of hazardous substances being used at worksites.

The Occupational Safety and Health State Plan Association reported that 16 of the 25 states or territories that administer their own occupational safety and health programs use the first category of data, workers' compensation, for a variety of safety and health-related purposes. Most often these data are used to aid in scheduling worksite inspections. The second category, accident reports, is another potential source of data on worksites that may be useful for targeting inspections. These reports would make a potentially powerful data base for identifying industry hazards and targeting inspections. At the very least, such an accident data base could generate ideas for special emphasis inspection programs. At present, however, employers only report fatal accidents or "catastrophes" (hospitalization of at least five workers) to OSHA. Thus, many accidents that might suggest safety and health violations are not reported to OSHA. In contrast, MSHA requires mine operators to report all accidents resulting in injury or death and some accidents that do not.

The third category, construction permits, could be required to help OSHA target projects that involve a substantial risk of injury, as is done in the California state program. In practice, it could be more a matter of contractors notifying OSHA. This notification could be required selectively for federally funded projects, for projects above a certain cost, or for specific hazardous operations (such as trenching or high-level scaffolding). H.R. 4652, pending before the 101st Congress (1989-90), for example, would require all construction contractors to provide the Secretary of Labor with specified data before commencing construction work.

The fourth category, notices of hazardous substances, could be a useful supplement to, or substitute for, targeting based on previously identified health violations. Some inspectors pointed out that it would be helpful to know what chemicals are being used at individual worksites and in what quantities. Some employers report these data under the Emergency Planning and Community Right to Know Act of 1986. OSHA may be able to use these data to better target health inspections.

The advantages of improved inspection targeting would be an increase in inspection activity at hazardous worksites, giving a greater return for OSHA's inspection effort. A more credible inspection targeting policy might also better encourage employers to abate hazards before they are inspected. Potential difficulties and disadvantages include the time and resources invested in identifying and testing targeting alternatives and, possibly, in collecting additional data. Finally, as long as OSHA has the resources to visit only a fraction of the nation's worksites each year, even the best possible inspection targeting system will leave many hazardous worksites uninspected.

Option 5: Inspect More of the Hazardous Worksites

OSHA could inspect more of the hazardous worksites if it (1) reduced the time spent on inspections with nonserious violations and (2) allowed private-sector consultations to substitute for some inspections.

Option 5a: Reduce Time Spent on Inspections With Nonserious Violations

One way to increase the number of inspections each inspector can conduct is to spend less time on inspections with no serious violations. This could be done by preparing no citation if the only violations were ones that OSHA considers to be "nonserious." In fiscal year 1989, OSHA issued about 11,000 citations that involved only nonserious violations; 27 percent of all inspections resulting in citations were for nonserious violations only. According to OSHA officials, to do this in the federally operated program would require a change in the legislation, even though at least three states with OSHA-approved, state-operated programs are using such a procedure.

California, Nevada, and Washington use this procedure to reduce the processing time for nonserious violations; this enables these states to focus inspection resources on more serious violations. Under this procedure in the California state program, employers agree, during an inspection, to abate the nonserious violation(s) and waive their appeal rights. In turn, the state agrees not to issue a citation. According to OSHA region IX officials, using this procedure, state inspectors in Nevada averaged 14 percent more inspections.

This procedure could allow OSHA inspectors more time for other functions, such as programmed inspections of high-hazard employers, without increasing the inspection work force. A disadvantage of using this procedure may be that there would be little incentive for employers to correct minor violations until inspected because there would be no risk of a fine. However, there is already little financial incentive to avoid a fine because the average fine is $2 per nonserious violation.

Option 5b: Allow Private-Sector Consultations to Substitute for Some Inspections

Another way to stretch the existing inspection work force would be to allow, under certain conditions, consultations by OSHA-certified private sector safety or health specialists as substitutes for targeted inspections. This would be an extension of OSHA's current policy of allowing certain small employers, through its consultation program, to obtain a 1-year exemption from targeted inspections. This program grants these exemptions to employers who receive a comprehensive consultation visit, correct all identified hazards, and demonstrate that they have an effective safety and health program in operation.[10]

OSHA could extend this option to other employers, including those who now are unable to obtain services under the consultation programs funded by OSHA and the states, because those programs give priority to small employers. By allowing employers to pay for these consultations, OSHA's costs would be limited primarily to (1) establishing procedures for certifying private sector specialists and (2) monitoring the quality of the services these specialists provide, as OSHA now monitors the consultation programs states provide.

A possible disadvantage of such an approach is the potential conflict of interest. The safety or health specialists might be reluctant to antagonize employers by identifying all the hazards. A vigorous monitoring role by OSHA would be needed to overcome such difficulties.

Option 6: Increase the Size of Civil Penalties

Given that OSHA is unable to inspect many worksites, it needs other ways to deter violators. Higher civil penalties are one potential deterrent. Increasing the maximum civil penalties is one way to enable OSHA to assess larger fines; another way is to more fully use existing penalties.

Option 6a: Increase the Maximum Civil Penalties

The Congress could increase the maximum civil penalties established in the act. OSHA's inspectors strongly endorsed the need to increase the maximum civil penalties in order for penalties to serve as a deterrent to employer safety and health violations. Almost half believed the penalties should be greatly increased; only 2.7 percent believed the penalties should be decreased. Half of the inspectors also believed that the maximum penalty for willful violations should be at least $25,000 per violation and $5,000 for serious violations. Penalty increases suggested by OSHA inspectors are about the same as those proposed in S. 490 during the 101st Congress. This bill would raise (1) the current penalty limit of $1,000 for a serious violation to $3,000 and (2) the current $10,000 limit for willful and repeated violations to $30,000.

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[10] Relatively few (about 2 percent) employers who receive consultation visits request an inspection exemption. OSHA officials believed employers may consider it too difficult to demonstrate that they have an effective safety and health program.

Option 6b: Fully Use Existing Penalties

Without any legislative change, OSHA could increase the penalties employers pay by (1) initially proposing higher penalties, (2) making fewer or smaller reductions in initial proposed penalties, and (3) making greater use of maximum penalties, such as the $1,000 a day penalty for failure to abate.

According to the act, an initial proposed penalty can be set less than the maximum by considering a number of factors, such as the size of the company. Although the act is silent concerning the extent to which these factors can affect the penalty, OSHA's guidelines allow for up to 80 percent reduction from the maximum for these factors. This reduction rate could be lowered to increase the deterrent value of penalties.

OSHA justifies reductions to the initially proposed penalty primarily as a means to get employers to abate workplace problems quickly without delaying abatement by contesting citations. (If employers contest citations, they do not have to abate the cited hazard until the case is resolved, thereby leaving workers unprotected.) For example, between March 1986 and February 1990, OSHA reached agreements with employers cited for egregious violations that reduced the initially proposed fines 66 percent —from a total of $29 million to $10 million—even though these employers had put their workers at serious risk through noncompliance. OSHA argues that the reductions were needed, in part, to have employers abate hazards quickly. However, by doing so, OSHA may be giving employers the impression that they will not be significantly penalized even if they willfully or repeatedly violate safety and health standards.

Penalties for failure to correct a violation may be up to $1,000 for each calendar day that the violation continues beyond the final abatement date. However, OSHA's Field Operations Manual says that normally the total proposed penalty for failure to abate shall not exceed 10 times the amount of the daily proposed penalty. Some inspectors believe that OSHA should not restrict the failure-to-abate penalty. They believe an employer should be penalized for each day that a violation goes unabated to provide an incentive for employers to abate hazards.

A possible negative consequence of OSHA's levying higher fines is that doing so might increase conflict between employers and OSHA, leading to more contested cases.

Option 7: Expand and Use Criminal Sanctions

To deter employers from willfully violating OSHA standards, the Congress could increase the severity of the act's criminal sanctions and encourage OSHA to use such sanctions. The Congress has criticized OSHA's record on the number of cases OSHA has referred to the Department of Justice for criminal prosecutions—57 in almost 20 years.[11] This number has been seen as indicating a reluctance to use criminal sanctions.

OSHA could do more administratively to obtain evidence, particularly on the necessary issue of criminal intent. OSHA has no investigation unit to handle potential criminal cases. Instead, it relies on the inspector to review the accident scene and to recommend appropriate action. Furthermore, the employer has 48 hours to report a fatality accident, even though it is generally recognized that getting to an accident scene quickly enhances an investigation.

In contrast, the state of California has an investigative unit—the Bureau of Investigations—for accidents. It consists of 10 people, 8 of whom are investigators, and fatalities must be reported immediately. In addition, California law is less restrictive than federal law, allowing criminal prosecution for a wider range of violations. The investigative unit provided data to local district attorneys who filed charges in 41 of 92 cases referred to them in 1985-86 alone. In comparison, the Department of Justice filed charges in 19 of the 57 OSHA referrals from 1970 to February 1990. As of February 1990, the Department of Justice had seven open cases.

The Congress could also increase the strength of sanctions for criminal cases so they correspond to the seriousness of the offenses. The size of the fine is, in the opinion of the Assistant Attorney General for Legislative and Intergovernmental Affairs, no longer limited by the act;[12] in addition, legislative changes could remove other limitations on the strength of criminal sanctions. These changes might address the nature of the charge that can be brought, the potential period of imprisonment, or the conditions under which criminal prosecution can be pursued. Under the act, a criminal violation is a misdemeanor offense with a 6-month maximum jail sentence; employers can only be charged for cases in which fatalities occur. These punishments may be doubled for convictions following the first offense. In contrast, the Resource Conservation and Recovery Act of 1976, which deals with hazardous waste, provides for up to 5 years' imprisonment for knowingly putting a person in imminent danger of serious bodily harm or death, whether or not a fatality occurs.

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[11] See Getting Away With Murder in the Workplace: OSHA's Nonuse of Criminal Penalties for Safety Violations (H. Rept. [illegible], Oct. 4, 1988).

[12] According to the Department of Justice, the Crime Control Act of 1984, which increased criminal fines for willfully violating federal statutes to $250,000 for individuals and $500,000 for companies, is applicable to Occupational Safety and Health Act provisions. Such fines should increase the prosecutive appeal of OSHA cases. However, OSHA officials told us that they have yet to pursue a criminal sanction under the Comprehensive Crime Control Act.

The Department of Justice supports the idea of increasing OSHA's criminal sanctions against employers for violation of OSHA standards. Responding to a congressional committee, the Department of Justice said, in a January 1989 letter, that it "would also be inclined to give serious consideration to proposals to expand the application of criminal sanctions to include violations which lead to serious injuries in addition to those which lead to the death of an worker."

According to OSHA officials, however, increasing criminal sanctions could lead to delays in having hazards abated. Employers would be more inclined to contest violations that could possibly result in criminal charges.

Two bills are pending before the 101st Congress—S. 2154 and H.R. 4050—which would expand criminal sanctions by (1) making violations felonies and (2) allowing OSHA to pursue criminal sanctions in certain nonfatality cases, as well as substantially raising the maximum penalty amount.

Option 8: Bar Violators From Federal Contract Competition

Federal agencies could use information from OSHA to bar employers who repeatedly violate OSHA safety and health standards from competing for federal contracts. Doing so could be an incentive for employers to comply with safety and health standards. Currently some agencies can do this administratively, but to achieve wider applicability legislation is probably needed. The federal government would, thus, be using the economic leverage of contracts to encourage employers to comply with OSHA regulations. The significant dollar value of federal construction contracts alone could provide a strong incentive for employers to meet OSHA regulations.[13]

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[13] For example, the Chicago Tunnel and Reservoir Plan project in Chicago represents federally funded capital expenditures of over $1.2 billion.

For example, construction projects that receive EPA assistance must comply with various federal regulations, including OSHA standards. In cases for which there is sufficient evidence of failure to meet responsibilities under the OSHA regulations, both contractors and grantees—bidders—could be debarred or suspended from eligibility for future EPA financial assistance.

It is unclear how different agencies should interpret the records of bidders' compliance with OSHA standards. If agencies are required to devise their own criteria to evaluate an employer's health and safety record, inequities may result as companies are able to win contracts from some agencies but are ineligible for contracts with other agencies. Any regulation setting such criteria should pay attention to these issues as well as those of equity and administrative cost.

Improve Hazard-Abatement Procedures

Problems With Hazard Abatement

Some employers have little incentive to abate promptly the hazards OSHA inspectors identify. Abatement can be delayed while (1) OSHA obtains a court order to get imminent hazards corrected or (2) employers contest an OSHA citation. In addition, OSHA conducts few follow-up inspections to confirm that employers have complied with their agreements to abate hazards; OSHA also does not require that employers provide evidence, such as photographs or invoices, that abatement has taken place.

Options to Improve Abatement

We believe that two options to better ensure abatement (see fig. 3.4) would encourage employers to abate the identified hazards more quickly—both in imminent danger situations and where the employer is contesting the citation. A third option would give OSHA more information about which employers have complied with their agreements to abate hazards.

Figure 3.4

GAO

Options to Improve Hazard-Abatement Procedures

- Give inspectors shutdown authority in imminent danger situations
- Protect workers while citation is contested
- Require proof of hazard abatement

Option 9: Give Inspectors Shutdown Authority in Imminent Danger Situations

In cases of imminent danger, the Congress could give OSHA inspectors shutdown authority without having to obtain a court order. MSHA and some state-operated safety and health programs have similar authority.

Imminent danger conditions should be quickly abated and, according to OSHA inspectors, generally are. OSHA could not provide data concerning the time involved in obtaining abatement of imminent dangers using the current procedures, which are described in appendix II. OSHA can usually get a court injunction, a region IX OSHA official said, within 24 hours. However, OSHA inspectors reported that workers were injured while OSHA was attempting to get abatement. Almost 80 percent of the OSHA inspectors said they should have shutdown authority in cases of imminent danger.

One disadvantage of this approach might be that inspectors would abuse the shutdown authority. However, the experiences of MSHA and the California state program provide little evidence that this would occur. In fiscal year 1988, MSHA used its shutdown authority for imminent danger about 1,200 times in the 97,217 inspections performed—about 1 percent of the inspections. In fiscal year 1987 (latest available data), the California program used its shutdown authority 72 times while conducting about 18,500 inspections—about 1 percent of the inspections.[14]

Option 10: Protect Workers While Citation Is Being Contested

The Congress could require employers to abate hazards while the employer is contesting a citation or penalty, providing workers with greater protection during this period. According to the act, if an employer contests OSHA's findings, the employer does not have to abate the hazard until the case is resolved except in two situations: The employer must correct the hazard when (1) only the penalty amount is contested or (2) the hazard presents an imminent danger to workers. However, according to OSHA's deputy director for compliance programs, an employer rarely contests only the penalty amount—the employer usually contests the entire citation.

If a hazard does exist, workers will continue to be at risk throughout the period of dispute over the citation. Given that the number of contested inspections has risen in recent years (from 1,055 in fiscal year 1984 to 3,372 in fiscal year 1989), protection may be delayed for an increasing number of workers.

A disadvantage to requiring abatement before disagreements are resolved is that the employer must comply before having his or her case heard—and the actions undertaken may ultimately be judged unnecessary. As a compromise, employers could be encouraged to provide at least temporary protection without requiring complete hazard abatement. If the employer refuses to provide reasonable protection for workers while a citation is in dispute, the employer could be assessed a surcharge or additional penalty if OSHRC upholds OSHA's citation. Another option could be additional penalties if workers are injured while an employer is contesting a citation. The act would need to be amended to implement either alternative.

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[14] It should be noted that shutdown does not necessarily mean closing an entire worksite, but, for example, shutting down a piece of machinery because the safety guard is missing.

Option 11: Require Proof of Hazard Abatement

OSHA could, with an administrative change, establish a regulation requiring employers to provide proof that abatement has taken place. This would supplement OSHA's current primary reliance on voluntarily provided written assurance from the employer.

Seventy-two percent of OSHA inspectors believe that abatement verification procedures should be changed. Of those, 75 percent believed that OSHA should do more follow-up inspections. While follow-up inspections would provide the best assurance that abatement has taken place, OSHA has too few inspectors to do many follow-ups. In the absence of follow-up inspections, OSHA needs to obtain evidence from employers in other ways. Currently, OSHA asks employers to provide documentation, such as invoices and photographs, along with their statements that abatement has taken place. However, there is no penalty to employers for failing to provide this evidence and, when it is not submitted, OSHA has only the employer's statement unless a follow-up inspection is performed. A regulation requiring documentary evidence might give OSHA better information about compliance.

Section 4

Strengthening the Roles of Employers and Workers

One way to improve safety and health in the workplace may be to strengthen the roles of employers and workers. This would mean both (1) encouraging employers and workers to identify and correct workplace hazards and (2) increasing OSHA's education and training efforts so that employers and workers would have the information they need to do so.

Problems With Current Roles of Employers and Workers

The major problems with the current involvement of employers and workers are their (1) lack of information about workplace hazards and how to correct them and (2) minimal active involvement in improving workplace safety and health.

OSHA inspectors and safety and health experts whom we interviewed expressed concern about the effectiveness of OSHA's education efforts in meeting the needs of employers or workers. In general, the most common criticism was that OSHA was providing insufficient education and training to workers and employers. Specific criticism was directed at OSHA for providing too little information to small employers and to certain groups of workers, such as those who are in construction, non-English speaking, employed in small businesses, and nonunion.

Many experts we interviewed believed that employers can take a more active role in providing worker safety and health. They believe that too many employers limit their efforts to compliance with specific standards—if they even do that—rather than taking a more assertive approach of systematically reviewing work operations, identifying risks, and establishing controls to avoid accidents and work-related illnesses. The reasons cited for low levels of employer involvement in safety and health activities range from insufficient economic incentives to lack of employer knowledge about OSHA and its regulations. Most workers have little involvement in workplace safety and health other than complying with rules designed to protect workers, such as wearing personal protective equipment. For example, the act, in contrast with legislation authorizing safety and health programs in the states of Oregon and Washington, does not require employers to consider workers' input on safety and health.

In addition, OSHA inspectors believe workers should be more involved in some activities now available to them. Fifty-nine percent of the inspectors said workers should be more involved in requesting an OSHA inspection; 65 percent, in accompanying inspectors as they walk about (called walkarounds) during inspections; and 70 percent, in participating in settlement discussions.

According to OSHA's Field Operations Manual, inspectors should ensure worker representatives are afforded an opportunity to participate in inspectors' walkarounds. However, in fiscal year 1989, only about 17 percent of all OSHA walkarounds included worker representatives. In unionized worksites, 40 percent of the walkarounds included worker representatives. In nonunion worksites, the participation was only about 4 percent. In a case in which a worker representative does not accompany the inspector, the inspector is required by law to consult with a reasonable number of workers concerning matters of health and safety in the workplace. It is difficult to obtain worker representatives at nonunion worksites, OSHA officials said, to accompany inspectors. This is also true for participating in settlement discussions.

One reason for workers' lack of involvement may be their fear of reprisal from employers. Recent GAO testimony pointed out that inspectors believe workers cannot freely exercise their rights without fear of reprisal.[1] For example, about one-fourth (26 percent) of the inspectors said workers have little or no protection from employer reprisals when they report violations to OSHA; only 15 percent said workers are well protected. OSHA officials told us that workers may also be reluctant to participate because the employer does not have to pay the worker for the time devoted to inspection activities.

Options to Strengthen the Roles of Employers and Workers

The options presented in this section (see fig. 4.1) are directed toward greater involvement of employers and workers in improving working conditions by (1) strengthening OSHA's education and training efforts, (2) requiring worksite safety and health programs and committees, and (3) increasing worker participation in the inspection process. These options are intended to supplement, not replace, OSHA's enforcement efforts.

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[1] How Well Does OSHA Protect Workers From Reprisal: Inspector Opinions (GAO/T-HRD-90-8, Nov. 16, 1989).

Figure 4.1

GAO **Options to Strengthen Roles of Employers amd Workers**

- Shift emphasis to programs that train more people
- Require certain employers to have
  - safety and health programs
  - safety and health committees
- Increase worker participation in the inspection prcess

Option to Improve Education and Training

OSHA could provide more education and training services. Providing more funds for compliance assistance activities would be one way to take care of the need, but it is unlikely that substantially more funds will be available. An alternative way is to make the available funds go further by putting greater emphasis on programs that reach more people directly.

Option 12: Shift Emphasis to Programs That Train More People

OSHA could allocate less of its funds to costly programs that are more costly per trainee and more to programs that are less costly per trainee, thus reaching more people. OSHA's most costly program, per trainee, is also the one on which most of its education and training funds are spent—the consultation program. (In every year since 1982, OSHA has spent at least 70 percent of its education and training funds on this program.) In 1988, the average cost to OSHA for the consultation program was about $772 per visit. In contrast, the New Directions Program cost OSHA about $50 per worker or employer trained in 1988, according to information OSHA gave us. OSHA has been phasing out the New Directions Program—the number of grantees funded peaked at 156 in 1980, and only 28 grants were awarded in fiscal year 1989—but it could reinstate that program or initiate new ones with a low cost per employer or worker trained.[2]

In considering a shift from one program to another, however, it is necessary to note fundamental differences in the approach of each. The consultation program provides site-specific comprehensive training to employers and can be used to train workers. OSHA officials also noted it is the only program focused on small employers. However, because of their confidentiality, consultation reports provide no information to other employers about safety and health concerns. The New Directions Program provides general, rather than site-specific, information about safety and health problems. It makes grants to labor and employer associations for members' training, which may include conducting workshops or distributing health and safety literature. The grants are intended to stimulate the creation of new, self-supporting education and training programs.

Options to Encourage Employers and Workers to Identify and Correct Workplace Hazards

Options to encourage employers and workers to reduce workplace hazards include (1) requiring certain employers to have safety and health programs, (2) requiring certain employers to have safety and health committees, and (3) increasing worker participation in the OSHA inspection process.

Option 13: Require Certain Employers to Have Safety and Health Programs

OSHA could require certain high-risk employers to develop safety and health programs, as defined by OSHA in recently issued voluntary guidelines.[3]

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[2] It has, for example, announced a new training and education program, the Targeted Training Grant Program, to focus on specific safety and health educational needs. However, the announced funding of $340,000 will make it substantially smaller than other training initiatives.

[3] The guidelines outline four principal elements of effective safety and health management: (1) management commitment and worker involvement, (2) worksite analysis, (3) hazard prevention and control, and (4) safety and health training.

In recent years, OSHA has noted the relationship between superior management of safety and health programs—which address all safety and health hazards whether or not covered by OSHA standards—and the low incidence and severity of worker injuries. Consequently, OSHA has two programs that encourage employers to voluntarily develop comprehensive safety and health programs—the consultation program and the voluntary protection program. OSHA data for fiscal year 1989 indicate that the consultation program, which is targeted specifically to small employers, provided technical assistance to over 21,000 small employers. The voluntary protection program recognizes employers who have developed a comprehensive safety and health program and who have injury rates considerably below their industries' average. As of September 1989, 64 employers had been recognized by OSHA.

Although OSHA has encouraged voluntary safety and health programs, most of the people we interviewed believe that OSHA should issue a standard making such programs mandatory for certain groups of employers. An overwhelming number of all inspectors (90 percent) said that repeat violators of OSHA standards and employers in high-hazard industries should be required to have safety and health programs. In addition, about 63 percent of the inspectors supported the idea of requiring such programs for all employers, regardless of industry type or reported numbers of injuries and illnesses. There already exists a standard requiring employers to have safety and health programs in the construction industry, and about half of the OSHA inspectors who had knowledge about the subject believe that this standard has at least "moderately improved" safety and health in the construction industry.

The experiences of the state-operated safety and health programs in Washington and California support the feasibility of requiring these programs. The state of Washington requires all employers, regardless of size, to maintain a written accident-prevention plan. One Washington program official believes that the program helps prevent workplace accidents by getting both employers and workers more involved. In 1989, California passed legislation requiring all employers to establish, implement, and maintain written injury prevention programs. This action was based, in part, on experience with a voluntary self-inspection pilot program, begun in 1979, at large construction sites. Under this program, labor and management agreed to set up joint safety committees and worksite safety programs. A 1983 study summarized the results of this program at six large construction sites. At all the sites, accident frequency rates appeared to be much lower than the industry average. At four sites, injury incidence rates were also lower than for comparable company projects. No major accidents or deaths were reported at any of the project sites. One company reported savings of $2.4 million through accident prevention. Although the study did not estimate the cost savings to the state, it did report that some costs—such as the cost of citations, appeals, and legal actions—were completely eliminated.

Since December 1988, in Oregon, state workers' compensation insurers have been required to provide free consultation services to employers. Under the state's insurer consultation rules, both insurers and self-insured employers are required to establish and help carry out loss-prevention services so that employers can improve their health and safety programs and reduce on-the-job injuries and illnesses. Little information is yet available about the impact of these activities on safety and health.

In response to OSHA's request for comments on its proposed voluntary safety and health management guidelines, most of the respondents expressed the belief that the guidelines described policies, procedures, and practices that are essential to worker safety and health protection but that can be met by a variety of methods. Most respondents, as well as OSHA, said that a significant number of worksites, particularly small- and medium-sized worksites, often lack the professional resources to develop adequate programs on their own.

Critics are also concerned about the cost of such programs. Cost would depend on many variables, such as the hazardous conditions of the workplace and the number of workers involved. We did not do a cost analysis of this option. Nevertheless, if OSHA determines that these programs are too costly, it may want to require plans only for those employers with high injury and illness rates.

Option 14: Require Certain Employers to Have Safety and Health Committees

OSHA could require all employers, or certain groups of employers, to have joint labor-management committees as a way to resolve job safety and health issues. Such committees are mandated in two U.S. states and in some localities in at least five other countries.[4] Committees can be used to investigate worksite accidents and to conduct regular inspections. They also can be used to settle safety and health disputes and provide input for management decisions about safety and health. In some countries, these committees also can investigate and abate hazardous situations. In the United States, one state (Washington) requires these committees in all worksites with 11 or more workers; Oregon requires them in worksites with 10 or more workers and high levels of injuries and illnesses.

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[4] Australia, Austria, Canada, the Federal Republic of Germany, and Sweden.

Safety and health committees are also provided for in almost half of all union contracts in this country. They exist, in various forms, in non-union worksites as well.

Joint labor-management safety and health committees could encourage local problem-solving and prevention activities, thus decreasing the reliance on OSHA's limited inspection force alone to seek out and order abatement of all worksite hazards. In addition, a state safety and health program official in Washington asserted, examining the minutes of safety committee meetings and talking with committee members helped inspectors conduct inspections; in particular, it gave inspectors information about the employer's commitment to worksite safety.

Granting workers the right to participate in decisions affecting job safety and health could benefit both employers and workers. Without such committees, when workers—especially those in non-union workplaces—spot worksite hazards, they have no structure in place to support them if they report the hazards to employers. Reporting hazardous work conditions to an on-site safety and health committee could more fully and immediately take advantage of worker knowledge than would reporting the hazard to OSHA and waiting for an inspection to be done if OSHA thinks a problem exists. If the employer does not abate the hazard, the worker would still have the option of requesting an inspection from OSHA.

Employers could also benefit from having workers report complaints to the committee since it would be a less adversarial action than requesting an OSHA inspection. Moreover, employers would have a forum from which they could sell their safety and health philosophy. Opening lines of communication may increase participation in safety and health, providing both an opportunity for an employer to use its expertise as well as increasing the role of workers in overseeing their own day-to-day safety practices.

The option of mandating joint labor-management safety and health committees has received mixed support from both employer groups and labor. For example, the AFL-CIO Standing Committee on Safety and Occupational Health recommends mandated worksite safety programs that would include provisions for joint committees. Some employer representatives we interviewed also supported the committee idea in theory.

However, most of them oppose making such committees mandatory rather than voluntary.

Management is often cautious about giving up any traditional management prerogatives. Unions are often concerned about incurring potential liabilities if some of its members are empowered to carry out safety and health tasks that are the responsibility of management.

OSHA officials believe establishing mandated joint committees would be difficult in nonunion worksites because of the difficulty in determining who will represent workers. According to a state official, however, requiring joint committees at nonunion worksites has not been a problem in Washington's program. The state requires that the worker representatives be elected directly by the workers, regardless of whether the worksite is union or nonunion.

Option 15: Increase Worker Participation in the OSHA Inspection Process

OSHA could encourage increased worker involvement in OSHAcompliance activities in order to improve the identification and abatement of hazards in the workplace. Ways to accomplish this include (1) having more worker representatives accompanying inspectors during walkarounds, (2) increasing worker involvement in settlement negotiations or allowing them to contest settlement agreements (legislative changes would be needed), and (3) involving workers in verifying hazard abatement.

Option 15a: Involve Workers in Walkarounds

OSHA could do more to include worker representation in the walkarounds. Even though the Field Operations Manual stresses the importance of workers' involvement, OSHA program officials told us that in practice inspectors have not included workers in many walkarounds at nonunion worksites.[5]

One reason for the limited involvement of nonunion workers in walkarounds may be that the Occupational Safety and Health Act allows for the participation of worker representatives in walkarounds undertaken by OSHA, but it does not mandate that workers be compensated for time spent accompanying an OSHA inspector during walkarounds. Some unions have bargained for walkaround pay or have elected to compensate members who participate in walkarounds. However, in nonunionized workplaces, workers may not be afforded the same benefits. Mandating walkaround pay would ensure that all workers are given the same opportunity to exercise the right to accompany OSHA inspectors during walkarounds, without the fear that their paychecks will be reduced. In 1977, the Secretary of Labor stressed the importance of having walkaround pay by saying that withholding it "[was] inherently destructive of the workers' right to participate in the walkaround and, consequently, impedes the free flow of information between workers and representatives of the Secretary which is so critical to effective enforcement of the act."

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[5] Although it could be difficult for an inspector to decide who should accompany him/her on the inspection, the Field Operations Manual already provides some guidance on such situations, and more could be developed.

Even though a 1978 court decision established that it is within the agency's authority to promulgate one,[9] OSHA currently does not have a rule on walkaround pay. If this option is to be implemented, legislative action may be needed to require OSHA to exercise this authority. Furthermore, the issue of compensating workers for participation in the inspection process may involve more than simply involvement in the walkaround itself. There are other activities in which workers may engage, such as informal OSHA conferences or attendance at safety and health committee meetings, for which compensation might also be considered.

Option 15b: Increase Workers' Participation in Settlement Negotiations

OSHA could take steps to more often include workers' representatives in the settlement negotiations with employers. OSHA asserts that workers have the right to be present during these negotiations, but acknowledges limited worker involvement in nonunion workplaces.

Including workers' representatives in discussions would give OSHA a viewpoint to balance that of the employers. It would give OSHA information on (1) workers' views on the appropriateness of withdrawing the citations or lowering penalties and (2) the feasibility and adequacy of the abatement agreements being reached. OSHRC has recognized that workers or their representatives have the right to be heard concerning the objectives of settlement agreement.

The possible disadvantage of increasing worker participation in settlement negotiations between OSHA and employers is the presence of a potentially hostile third party. This might limit OSHA's ability to exercise practical discretion when determining the final action to be taken against an employer. The objections of workers to settlement agreements may further involve the agency in litigation against employers, which would delay timely remedies to potentially hazardous or fatal safety and health violations.

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[9] Chamber of Commerce of the United States v. OSHA, 465 F. Supp. 10 (D.D.C., 1978).

If OSHA is unable to obtain adequate worker participation, for whatever reason, in settlement negotiations, the Congress may choose to amend the act. Workers could be allowed to appeal the final settlement to an administrative law judge for review when there is (1) evidence that the settlement is not serving the purpose of protecting the health and safety of workers or (2) no adequate mechanism for monitoring compliance with the terms of an agreement. However, it should be recognized that providing this worker right could delay hazard abatement while the settlement is being contested.

Option 15c: Involve Workers in Verifying Hazard Abatement

OSHA could establish a mechanism to use workers as a source of information about whether employers have corrected the cited hazards. One way to do this would be to require employers to post at the worksite the information they provide to OSHA about how and when they abated the hazards. This would parallel the current requirement that the employer post the citation notice. Given this information, if workers' observations are inconsistent with the employers' assertions, workers could notify OSHA.

Appendix I

Methodology

Overview

We collected information about how the federal government protects workers from occupational safety and health hazards, perceived problems with these programs, and practical options to improve them. We collected this information through (1) interviews with safety and health experts outside the government, as well as federal and state program administrators; (2) a mail questionnaire to OSHA compliance officers and their supervisors; [illegible] review of published articles on safety and health; (4) an examination of OSHA operating procedures, documents, and performance data; and (5) a review of legislative initiatives in the 99th, 100th, and 101st Congress.

We obtained information from OSHA through interviews with headquarters officials and copies of a questionnaire to those individuals responsible for doing and supervising inspections.[1] In commenting on a draft of this report, OSHA expressed concern that in relying on a questionnaire sent to inspectors and supervisors, we missed an important and informed source of information, specifically, regional and area office and senior field managers. We did not send the questionnaire to these officials or systematically obtain data from them. However, in other recent and ongoing GAO reviews, we have talked with OSHA managers at those levels, and we built on that knowledge in designing and implementing this review. Moreover, we did interview OSHA officials in region IX to discuss the OSHA enforcement program in California and OSHA's policies and procedures in general.

For our interviews with 32 safety and health experts outside the government, we selected people who would provide a good balance of perspectives: 8 from labor,[2] 9 from management,[3] 10 from academia, 3 from professional organizations, and 2 with state program experience. Several of them had previously held positions in OSHA or NIOSH.

We met with nine experts in a 1-day structured panel discussion. We conducted the other interviews individually, primarily using a structured interview guide to address areas selected to review. The interviews covered general observations on safety and health in this country; then the interviews focused, in turn, on each topic, asking for the problems, if any, the experts saw; what alternatives might be considered; and the advantages and disadvantages of each. We also solicited their opinions on some specific options.

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[1] Questionnaire results will be issued as a separate report in the near future.

[2] Five are labor union representatives and three others represent advocacy groups with, primarily, a labor perspective.

[3] Five were from individual companies; four were from business associations.

We mailed copies of two different questionnaires to OSHA compliance officers and their supervisors, who are principally responsible for seeing that private employers comply with OSHA safety and health regulations and standards. (For convenience, we refer to all compliance officers and supervisors jointly as "inspectors.") We selected a random sample from current OSHA safety and health officers. All current OSHA field supervisors of safety and health inspectors were also surveyed. The compliance officers and supervisors worked in all 10 of OSHA's regions. The two questionnaires were identical except for minor modifications to reflect wording differences because of compliance officers' and supervisors' different positions and responsibilities.

To identify differences between the programs, we also compared OSHA's operations with approaches used by state-operated safety and health programs. For three state programs—California, Oregon, and Washington—we obtained performance data, when available, on approaches that OSHA did not use or that were different from the federal program. We also identified different and additional program elements by the Labor Department's Mine Safety and Health Administration (MSHA), which protects the nation's miners.

The major factors we considered in selecting options were (1) frequent identification by safety and health experts or in the literature and (2) the extent of evidence we were able to obtain concerning feasibility of the options. We did not analyze the cost-effectiveness of the options. We present the options for congressional and Department of Labor consideration in making legislative and administrative changes.

Sampling Approach for Questionnaire

We obtained listings from OSHA identifying all inspectors as of April 12, 1989. We divided safety and health officers into separate universes and sampled each individually. Within each regional office we selected a random sample of approximately one-third of all safety officers and one-third of all health officers. Universe and sample sizes by type of inspector are shown in table I.1.

Table I.1: Total Inspectors and Total Sampled by Type

Inspector	Total	Sample	Percent
Safety officers	552	184	33.3
Health officers	415	138	33.3
Supervisors	155	155	100.0
Total	**1,122**	**477**	**42.5**

We mailed a questionnaire to each inspector in our sample and to all supervisors; we sent one follow-up mailing to those who initially did not respond. Eighty-one percent of those to whom we sent questionnaires responded.

For the two questionnaires, we were only interested in surveying compliance officers and supervisors who actually did or supervised inspections. OSHA's listings did not identify workers by occupation; thus, we were not able to restrict our sample cases only to inspection staff. We, therefore, used a screening question in our questionnaire to select respondents who were either doing or directly supervising inspections. We deleted from our sample those who were not. The number and percentage considered appropriate for our analysis are shown in table I.2.

Table I.2: Respondents Doing (or Supervising) Inspections by Sampled Group

				Respondents doing inspections	
Group	Sample	Respondents	Sample responding (in percent)	Number	Percent
Safety officers	184	146	79.3	124	84.9
Health officers	138	113	81.9	95	84.1
Supervisors	155	127	81.9	117	92.1
Total	**477**	**386**	**80.9**	**336**	**87.0**

Questionnaire results are projectable to an estimated universe of compliance officers and supervisors who were doing inspections and who would have responded had we sent the questionnaire to everyone. The size of the universe to which results can be projected after adjustments for both the response rate and the rate of respondents' doing inspections are shown in table I.3.

Table I.2: Universe to Which Questionnaire Results Can Be Projected: Respondent Universe Doing Inspections

Group	Universe	Respondents		Respondents doing inspections	
		Rate	Universe	Rate	Universe
Safety officers	552	79.3	438	84.9	372
Health officers	415	81.9	340	84.1	286
Supervisors	155	81.9	127	92.1	117
Total	**1,122**		**905**		**775**

The one instance in which we project our questionnaire results without adjusting the universe for the respondent rate is in estimating the number of compliance officers doing inspections. We then assume that the percentage of nonrespondents conducting inspections was the same as the percentage of respondents—84.9 percent for safety and 84.1 percent for health. As a result, we estimated that 818 compliance officers were doing inspections (552 x .849 + 415 x .841). The sampling error is plus or minus 36.

Estimates derived from a statistical sample are subject to a certain amount of sampling error: the possible error that arises because of taking a sample rather than surveying the entire population. Sampling error, also called a precision of the estimate, is given as a plus or minus value around the estimate. The sampling errors for percentages reported did not exceed plus or minus 7 percent for any estimate.

Enforcement Procedures

OSHA's enforcement program primarily consists of the following activities:

- scheduling and conducting inspections,
- issuing citations and assessing penalties, and
- verifying abatement.

Scheduling Inspections

Every worksite covered by the act is subject to inspection by OSHA. An annual rider to OSHA appropriations, however, generally exempts from inspection those employers with fewer than 11 workers and average injury rates below the national average.[1] OSHA administrative practice has been to extend this exemption from programmed inspection to all small employers regardless of their average injury rates.

Inspections are categorized as safety or health inspections. In fiscal year 1989, 81 percent of the inspections were safety inspections. Inspections can also be categorized as either programmed or unprogrammed. Unprogrammed inspections include those that receive priority because of (1) an alleged imminent danger situation, (2) an accident involving a fatality or catastrophe, (3) a complaint alleging serious violations that threaten physical harm, or (4) a referral from other officials, agencies, or the media, describing a potential, serious hazard. Thirty-eight percent of OSHA's unprogrammed inspections in fiscal year 1989 resulted from worker complaints; unprogrammed inspections accounted for about 57 percent of all OSHA's inspections.

Programmed, or targeted, inspections are those that are based on a neutral system rather than specific information about that employer. OSHA has separate targeting procedures for three major inspection categories: safety inspections in high-hazard manufacturing industries, safety inspections in the construction industry, and health inspections in high-hazard industries. Most of the programmed inspections are done in high-hazard manufacturing industries or construction.

Under the current targeting procedure for high-hazard manufacturing industries, each OSHA area office develops its own annual inspection programs based on (1) an OSHA-provided ranking of high-hazard manufacturing industries by industry lost workday injury (LWDI) rate for the state and (2) a listing of high-hazard worksites in that area, in order of their industry LWDI rates. Industry LWDI rates are based on the results of a BLS annual occupational safety and health survey, and OSHA derives its listing of companies from a Dun and Bradstreet file.

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[1] They are, however, subject to inspections based on an unsolicited formal complaint or a reported catastrophe (an accident in which five or more workers are hospitalized) or fatality.

OSHA's primary source for identifying construction sites is the Dodge Reports, a commercial publication identifying planned construction starts. A list of construction sites randomly selected from these reports is provided to area offices monthly by the Tennessee Construction Resource Analysis Department at the University of Tennessee.

When OSHA compliance officers inspect a construction site, they inspect all contractors and subcontractors active at the site—with each contractor recorded as one inspection in OSHA's records. If a site is inactive when visited by the compliance officer, it can be rescheduled in the next year's inspection cycle.

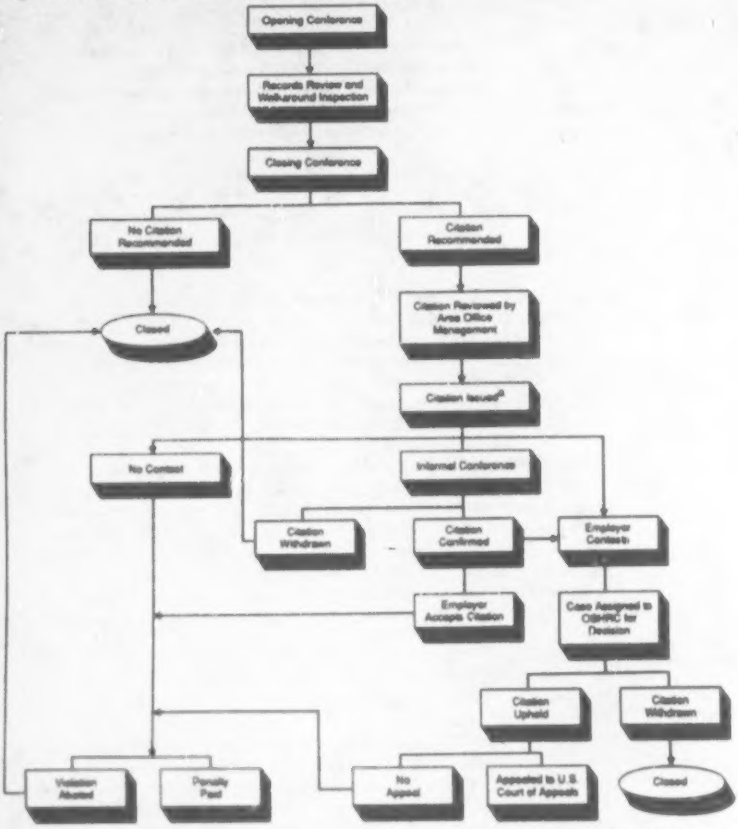
As it does for high-hazard safety inspections, OSHA annually provides each area office with a ranked listing of industries for health inspections and a listing of area worksites in each industry. For the health listings, however, industries are ranked according to the average number of serious health violations cited per OSHA health inspection in that industry. The industry ranking is a national one; therefore, all area offices have the same industry priorities.

From these listings, the area office decides on health inspection cycles and conducts inspections using a procedure similar to that for scheduling industry safety inspections. In recent years, OSHA's health inspection program has been increasingly driven by complaints, leaving fewer resources for targeted inspections. Because an area office is required to complete an inspection cycle once it is started, some area offices, in 1988, were still working on their 1985 or 1986 inspection cycles and completing only a handful of targeted health inspections each year.

Conducting Inspections

As shown in figure II.1, the worksite inspection begins with an opening conference in which the inspector explains the reason the worksite was selected, the purpose of the visit, and the scope of the inspection. After the opening conference, the inspector reviews the injury and illness log and begins a walkaround of the work areas for compliance with OSHA standards. While inspecting, the inspector observes worksite conditions, consults with workers, and examines records. Any unsafe or unhealthful working conditions are pointed out to the employer and

Figure II.1: OSHA Inspection and Citation Resolution Process


Opening Conference
Records Review and Walkaround Inspection
Closing Conference
No Citation Recommended
Citation Recommended
Closed
Citation Reviewed by Area Office Management
Citation Issued[a]
No Contest
Informal Conference
Citation Withdrawn
Citation Confirmed
Employer Contests
Employer Accepts Citation
Case Assigned to OSHRC for Decision
Citation Upheld
Citation Withdrawn
Violation Abated
Penalty Paid
No Appeal
Appealed to U.S. Court of Appeals
Closed

[a] Instance by instance citations are approved by regional administrator and OSHA headquarters. Other citations are approved by area office director.

worker representatives. After the inspection, a closing conference is held. The inspector discusses with the employer the unsafe or unhealthful conditions observed and indicates the apparent violations, correction procedures, and interim methods of control.

Issuing Citations and Assessing Penalties

A citation is issued when safety or health hazards have been identified during an inspection. The citation describes the standard violated, proposes the penalties (if any), and establishes the date by which the employer must abate (eliminate) the safety or health hazard.

An employer who disagrees with any aspect of the citation can request an informal settlement conference with the OSHA area office director. Issues discussed in the settlement conference include such matters as the type of violation (for example, whether it was serious or nonserious), the amount of the penalty, the abatement actions to be taken, and the date by which abatement must occur. If a settlement is reached, an informal settlement agreement is signed.

If an agreement cannot be reached at the informal settlement conference, the employer can file a notice of contest within 15 days of the issuance of the citation. Employers can contest a violation if they believe it did not occur, the violation was less serious than cited, the abatement period is unreasonable, or the penalty was excessive. The Occupational Safety and Health Review Commission (OSHRC) will hear the case and render a decision.

Under certain circumstances, OSHA can refer the case to the Justice Department for criminal prosecution. The act allows criminal penalties (1) if an employer willfully violates an OSHA standard, resulting in a worker's death, or knowingly makes false representation and (2) if a person knowingly tells an employer that an inspection is scheduled without authority from the Secretary or his designees.[2]

Verifying Abatement

Abatement is the elimination of an identified hazard. It can be accomplished in a variety of ways, including (1) changes in the facilities, machinery, materials, or work practices used or (2) addition of personal protective equipment for workers. Sometimes employers will abate a hazard as soon as it is pointed out by an inspector; employers, however, are generally allowed additional time to abate a hazard. The citation specifies the date by which an employer must abate a hazard and inform the area office of that fact.

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[2] The maximum penalty is $10,000 or imprisonment for 6 months or both. But telling an employer about a pending inspection carries a maximum fine of $1,000 or imprisonment for 6 months or both.

If the employer contests the citation, abatement is further delayed until resolution of the contest in a formal settlement or a decision of OSHRC. If an employer contests the penalty or only part of the citation, all uncontested items must still be abated by the dates indicated on the citation and the corresponding penalties paid within 15 working days of notification. However, employers need not abate hazards related to contested sections of the citation until a final decision is made.

The procedures for obtaining abatement in imminent danger situations are somewhat different. Imminent danger is defined as

> "any conditions or practices in any place of employment which are such that a danger exists which could reasonably be expected to cause death or serious physical harm immediately or before the imminence of such danger can be eliminated through enforcement procedures otherwise provided by this act."

Workers can identify potential imminent danger situations and request an inspection or the inspector could note such dangers during the inspection.

As soon as the inspector concludes that conditions or practices exist that constitute an imminent danger, the employer is advised. It is the duty of the inspector at the site of an imminent danger situation to encourage the employer to do whatever is possible to eliminate the danger.

If the employer either cannot or does not voluntarily eliminate the hazard, the inspector notifies the area director, who decides whether to post on site a Notice of Alleged Imminent Danger. This notice does not constitute a citation of alleged violation or a notice of proposed penalty. It is only a notice that an imminent danger is believed to exist and that the Secretary of Labor will be seeking a court order to restrain the employer from permitting workers to work in the area of the danger until it is eliminated.

The regional administrator is notified and, in turn, ensures that the OSHA director of field programs is notified before a temporary restraining order is sought. According to OSHA officials, four restraining orders were obtained between fiscal years 1984 and 1988.

OSHA has several methods for confirming that abatement has taken place. Currently, the method used most often is written assurance from the employer.

Roles of Employers and Workers

Employers Are Expected to Provide Workplaces Free From Safety and Health Hazards

Each employer is required, under the act, to provide workers with employment that is free from recognized hazards that are causing or that are likely to cause serious physical harm or death.

Some safety and health standards set by OSHA provide information to employers about how they are expected to meet that requirement. Such standards encompass many hazards in many industries, and are not limited to substances alone. They apply to work processes, equipment, and training requirements for certain categories of workers as well as to hazardous chemicals. Employers are expected to be knowledgeable about, and comply with, over 700 federal OSHA standards.

In addition to specific standards, OSHA also issues voluntary guidelines for employers. For example, in January 1989, the agency issued voluntary guidelines, encouraging employers to establish safety and health programs. Other organizations' guidelines, such as the Centers for Disease Control's recommendations for protection against bloodborne diseases, have also informed employers about procedures to protect workers. Some of these guidelines have been used by OSHA as evidence that employers who operate counter to the guidelines are failing in their general duty to maintain a safe workplace—and thus OSHA has cited them, using the "general duty" clause of the act.

OSHA has also initiated programs to provide recognition for employers who maintain exemplary safety and health programs. These programs, known as voluntary protection programs, were adopted by OSHA in 1982. The purpose of these programs is to (1) recognize qualified employers whose safety and health programs far exceed federal requirements and (2) encourage more employers to provide outstanding worker protection. The safety and health programs include management systems for preventing or controlling occupational hazards; these programs provide the best feasible protection at worksites, even beyond OSHA standards. Participants are removed from OSHA's programmed inspections, thus freeing OSHA's inspection resources to be used more effectively. In fiscal year 1989, 64 worksites participated in the program.

The voluntary protection programs have shown that a more cooperative approach to worker safety and health between government, industry, and labor can be achieved. OSHA has recognized that compliance with its standards cannot accomplish all of the goals established by the act, nor will the standards cover all unsafe conditions in the workplace. These programs are based on the premise that having a comprehensive voluntary safety and health program that operates effectively can provide increased worker protection with fewer agency resources.

Workers Are Expected to Follow Procedures Established to Protect Them

Workers are expected to comply with procedures established to protect them. To assist them, employers are required to inform workers of the chemical hazards to which they may be exposed at work and what precautions they should take. OSHA also requires employers to (1) post a notice informing workers of their rights under the act and (2) provide workers access to records on injuries and illnesses that have occurred in the workplace. Workers can also request information on any substance from NIOSH.

The act provides that workers can inform OSHA when employers are not providing a safe workplace. Workers have the right to be represented in OSHA walkarounds, to report violations to the compliance officer during an inspection, and to request an inspection when they believe that an imminent danger or a violation of a safety or health standard that threatens physical harm exists.

Section 11(c) of the act protects workers against employer reprisals for exercising the above rights or any other rights included in the act. In order to carry out the mandate to protect workers against employer reprisals, OSHA operates a discrimination complaint investigation program. Through this program, OSHA investigators examine complaints of employer reprisals and determine whether or not to pursue complaints through the courts.

Education and Training

The Congress acknowledged the need for workers and employers to be knowledgeable about workplace hazards in order to achieve the objectives of the Occupational Safety and Health Act, and OSHA provides education and training for workers and employers through both agency-funded activities and employer-funded activities. Directly funded activities include the employer consultation program, the OSHA Training Institute, the New Directions Grant Program, and publications. In addition to these directly funded activities, there are more than 100 OSHA standards and guidelines that mandate or recommend minimum levels of training to be provided by employers for particular categories of workers. OSHA also expects education and training to be a component of its other activities, such as conducting inspections.

Consultation

Education and training directly funded by OSHA are aimed primarily towards employers. OSHA's primary emphasis in education and training has been on the Employer Consultation Program, which, in each year since 1982, received at least 70 percent of all the education and training funds. The funds devoted to this program alone constitute approximately 10 percent of OSHA's overall budget for fiscal year 1989.

Employers who want help in identifying and controlling safety and health hazards may obtain free consultation assistance under the Consultation Program, which is funded by OSHA and the states. The program is designed to assist smaller businesses in high-hazard industries or with especially hazardous operations. The proportion of federal funds to state funds varies from state to state, depending on what type of agreement the states have with federal OSHA. In fiscal year 1988, 29 states and U.S. jurisdictions provided consultation services to employers through agreements in which 90 percent of the program's funding comes from federal OSHA and 10 percent comes from the states; 23 states provided consultation services in which federal OSHA funds 50 percent of the cost of the service and the states fund 50 percent.

The program is provided to employers on a confidential basis. No citations are issued or penalties proposed for hazards identified by a consultant. An employer is, however, obligated to correct serious job safety and health hazards promptly. OSHA does not require employers to provide workers with information about hazards identified by a consultant or about recommended abatement measures.

OSHA Training Institute

The OSHA Training Institute provides short-term basic and advanced training and education in occupational safety and health for the public and private sectors. Training programs are designed to (1) improve the skill and knowledge of personnel engaged in work related to the act and (2) train and educate employers and workers in the recognition, avoidance, and prevention of unsafe and unhealthful working conditions. During fiscal year 1988, the institute trained 7,842 people. About 16 percent of those attending courses at the institute in 1988 were private sector employers and employee representatives.

New Directions Grants

New Directions, the agency's training and education grant program, makes funds available to nonprofit labor and employer organizations that want to provide job safety and health training to their memberships. The grants are designed to develop job safety and health expertise in recipient organizations. Generally, grantees become independent of federal funding after a 3-year to 5-year developmental period.

OSHA is able to selectively target certain groups of workers and employers through New Directions grants. Currently, OSHA is not awarding new grants; targeted groups have, therefore, been limited to those groups that have already been awarded grants and are finishing out their 3-year to 5-year developmental periods.

Mandated Worker Education and Training

In addition to these formal programs, there are regulations and standards issued by OSHA that are aimed specifically at increasing the level of knowledge among workers about health and safety hazards. More than 100 of OSHA's current regulations and standards contain some requirement for training. These include the OSHA Access to Records regulation and the hazard communication standard. The Superfund Amendments and Reauthorization Act of 1986, title III, also provides for making workers aware of hazards. In addition, OSHA has issued voluntary guidelines to assist employers in identifying training needs of workers.

The OSHA Access to Records regulation, as revised in July 1978, states that workers have the right to examine the illness and injury logs of employers, as well as summaries of recorded occupational injuries and illnesses in their worksites. Since 1980, workers have also had the right to examine workers' exposure and medical records. The workers' right to information also extends to information about toxic subestances to which they may be exposed in the workplace.

The hazard communication standard, issued first in 1983 and revised in 1986 and 1987, requires chemical manufacturers, importers, and distributors of hazardous chemicals to (1) describe known hazards on material safety data sheets (MSDSs), which must be provided to employers to whom chemicals are shipped, (2) label containers of such chemicals, and (3) update the MSDSs whenever information changes significantly. Employers, in turn, are required to institute programs ensuring that (1) the information provided to them is communicated to workers who handle these chemicals and (2) workers are aware of their right to obtain such information. Employers who must prepare or have available

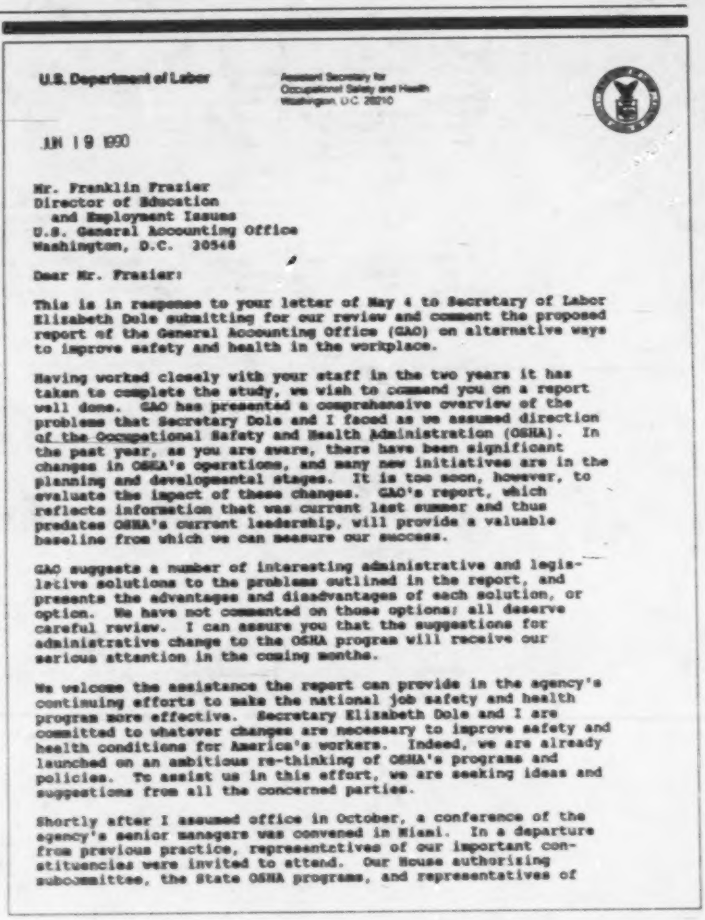
MSDSs for hazardous chemicals in their worksites must also submit chemical hazard information to state emergency response commissions, local emergency planning committees, and local fire departments.

The Superfund act requires OSHA to issue a standard to provide workers engaged in hazardous waste operations with protection at least equivalent to that provided by EPA. The standard was mandated to cover various areas of worker protection, including site analysis, training, medical surveillance, and protective equipment. The final rule, which was published on March 6, 1989, and became effective March 6, 1990, protects approximately 1.75 million workers who work with toxic wastes, including those who respond to hazardous waste spills, such as firefighters, police officers, and ambulance and hazardous materials personnel. The standard also protects workers who are involved with operations at uncontrolled hazardous waste dump sites and workers at waste storage, treatment, and disposal facilities.

Several training requirements are included in the standard. One of these is that workers who work in hazardous substance removal operations will be required to have at least 40 hours of initial training before entering a site and at least 3 days of actual field experience.

Appendix IV

Comments From the Department of Labor



U.S. Department of Labor

Assistant Secretary for
Occupational Safety and Health
Washington, D.C. 20210

JUN 19 1990

Mr. Franklin Frazier
Director of Education
  and Employment Issues
U.S. General Accounting Office
Washington, D.C. 20548

Dear Mr. Frazier:

This is in response to your letter of May 4 to Secretary of Labor Elizabeth Dole submitting for our review and comment the proposed report of the General Accounting Office (GAO) on alternative ways to improve safety and health in the workplace.

Having worked closely with your staff in the two years it has taken to complete the study, we wish to commend you on a report well done. GAO has presented a comprehensive overview of the problems that Secretary Dole and I faced as we assumed direction of the Occupational Safety and Health Administration (OSHA). In the past year, as you are aware, there have been significant changes in OSHA's operations, and many new initiatives are in the planning and developmental stages. It is too soon, however, to evaluate the impact of these changes. GAO's report, which reflects information that was current last summer and thus predates OSHA's current leadership, will provide a valuable baseline from which we can measure our success.

GAO suggests a number of interesting administrative and legislative solutions to the problems outlined in the report, and presents the advantages and disadvantages of each solution, or option. We have not commented on those options; all deserve careful review. I can assure you that the suggestions for administrative change to the OSHA program will receive our serious attention in the coming months.

We welcome the assistance the report can provide in the agency's continuing efforts to make the national job safety and health program more effective. Secretary Elizabeth Dole and I are committed to whatever changes are necessary to improve safety and health conditions for America's workers. Indeed, we are already launched on an ambitious re-thinking of OSHA's programs and policies. To assist us in this effort, we are seeking ideas and suggestions from all the concerned parties.

Shortly after I assumed office in October, a conference of the agency's senior managers was convened in Miami. In a departure from previous practice, representatives of our important constituencies were invited to attend. Our House authorizing subcommittee, the State OSHA programs, and representatives of labor, business, and public interest groups were invited to join the agency's senior managers in brainstorming. The goal was to come up with innovative solutions to the challenges OSHA faces. Many months and task forces later, we have put into effect some of the hundreds of good suggestions that came out of the Miami meeting, and we are in the process of sorting out others for further consideration.

In addition to regular meetings with our three statutory advisory committees, we have held or are planning to hold a number of conferences with interested and knowledgeable parties outside the agency. For example, we met in March of this year with the Surgeon General and senior officials of the National Institute for Occupational Safety and Health to determine how to better coordinate our respective activities to achieve our common mission. On June 21, we will be meeting with representatives of worker compensation insurance companies to discuss issues of mutual interest. A conference with the parties concerned with safety and health in the petrochemical industry is planned for the Fall.

To ensure the orderly consideration of the many new ideas pouring into us from these sources, I have set up a new, internal decision-making process. An agency policy review board comprised of OSHA's senior managers now meets at least once a month to evaluate new policy initiatives or proposals for change in existing policies and to recommend options for my consideration.

It should not surprise you that there are similarities between OSHA's own, ongoing self-analysis of its programs and policies and the analysis in GAO's report. There are also differences. Our specific comments, which follow, address those differences.

Regulatory Strategy

OSHA defines its regulatory strategy somewhat differently from GAO. Given the limited reach of agency inspections, OSHA relies to a large extent on voluntary compliance by employers and employees. Ideally, enforcement actions, with appropriate citations and penalties, should be necessary only when employers fail for whatever reason to consider safety and health as an integral part of their responsibilities to employees. OSHA consequently has developed a regulatory strategy that combines rigorous enforcement with intensive educational and assistance efforts. Not only does the agency promote training and education through formal training and assistance programs and the training requirements in many OSHA standards, but training and education are integrated into every major agency activity.

Deterrence

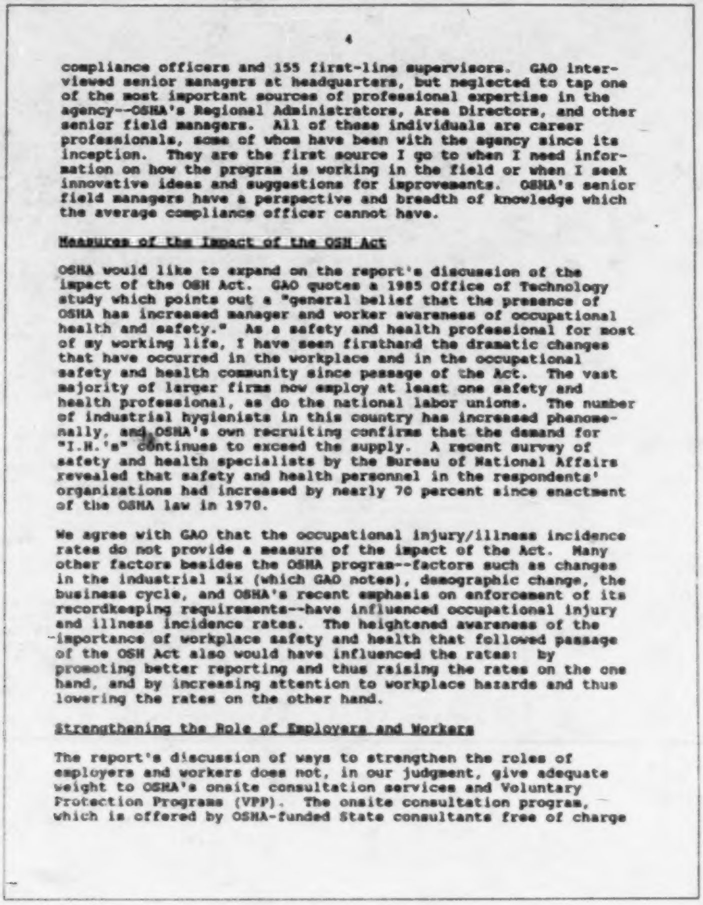
The success of OSHA's regulatory strategy depends upon strong incentives for all employers, inspected or not, to comply with the requirements of the OSH Act. GAO describes OSHA's policy of issuing large dollar penalties for particularly egregious violations of the OSH Act, but does not note the significance of that policy in maximizing the impact of a single inspection. In recent years, under this policy, OSHA has used the civil penalty process to emphasize the seriousness of safety and health violations and to multiply the deterrent effect of a single inspection. Since 1986, OSHA has issued approximately 100 citations to approximately 90 employers for egregious violations. Almost two-thirds of these cases have been settled prior to a hearing, thereby securing swift abatement of hazards. Many of the presently contested citations are close to settlement. We are convinced that this extremely high settlement rate is a direct result of the business community's recognition of the Department's commitment to well-documented inspections and to pursuing litigation if necessary.

Nor does GAO note the significance of OSHA's corporate intervention strategies as a means of maximizing the impact of a single inspection. In a number of instances, OSHA has been able to get agreement from the parent corporation of a plant that has been inspected, not only to correct the violations found on that inspection, but also to make similar corrections in other plants where the same violative conditions exist. For example, OSHA's first egregious cases in the poultry and red meat industries resulted in agreement by the parent corporations to implement ergonomics programs in all their plants. To date, we have entered into 13 corporate-wide settlement agreements in a number of industries including automobile and paper manufacturing. Monitoring the implementation of corporate-wide settlement agreements is becoming an increasingly important part of OSHA's compliance program.

OSHA is considering other corporate-intervention strategies. A recent example of successful OSHA intervention at the corporate level was the agency's review, during an investigation of employee complaints, of employee medical records at the corporate headquarters of two asbestos-removal firms. OSHA supplemented this headquarters paper review with employee interviews. The approach used in these two cases proved effective and efficient. OSHA was able to accomplish its objective of uncovering and correcting serious violations of the asbestos standard without visiting the many separate worksites of these firms.

Survey of OSHA Compliance Officers and Supervisors

OSHA believes that throughout the report GAO places too much reliance on the results of the survey it conducted of 322 OSHA



compliance officers and 155 first-line supervisors. GAO interviewed senior managers at headquarters, but neglected to tap one of the most important sources of professional expertise in the agency--OSHA's Regional Administrators, Area Directors, and other senior field managers. All of these individuals are career professionals, some of whom have been with the agency since its inception. They are the first source I go to when I need information on how the program is working in the field or when I seek innovative ideas and suggestions for improvements. OSHA's senior field managers have a perspective and breadth of knowledge which the average compliance officer cannot have.

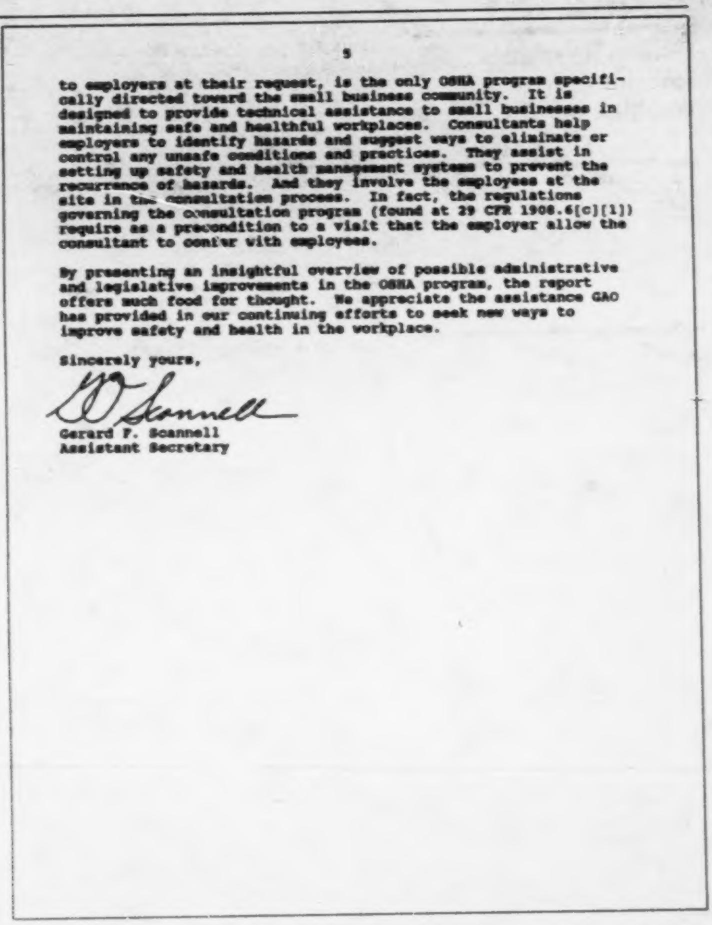
Measures of the Impact of the OSH Act

OSHA would like to expand on the report's discussion of the impact of the OSH Act. GAO quotes a 1985 Office of Technology study which points out a "general belief that the presence of OSHA has increased manager and worker awareness of occupational health and safety." As a safety and health professional for most of my working life, I have seen firsthand the dramatic changes that have occurred in the workplace and in the occupational safety and health community since passage of the Act. The vast majority of larger firms now employ at least one safety and health professional, as do the national labor unions. The number of industrial hygienists in this country has increased phenomenally, and OSHA's own recruiting confirms that the demand for "I.H.'s" continues to exceed the supply. A recent survey of safety and health specialists by the Bureau of National Affairs revealed that safety and health personnel in the respondents' organizations had increased by nearly 70 percent since enactment of the OSHA law in 1970.

We agree with GAO that the occupational injury/illness incidence rates do not provide a measure of the impact of the Act. Many other factors besides the OSHA program--factors such as changes in the industrial mix (which GAO notes), demographic change, the business cycle, and OSHA's recent emphasis on enforcement of its recordkeeping requirements--have influenced occupational injury and illness incidence rates. The heightened awareness of the importance of workplace safety and health that followed passage of the OSH Act also would have influenced the rates: by promoting better reporting and thus raising the rates on the one hand, and by increasing attention to workplace hazards and thus lowering the rates on the other hand.

Strengthening the Role of Employers and Workers

The report's discussion of ways to strengthen the roles of employers and workers does not, in our judgment, give adequate weight to OSHA's onsite consultation services and Voluntary Protection Programs (VPP). The onsite consultation program, which is offered by OSHA-funded State consultants free of charge



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to employers at their request, is the only OSHA program specifically directed toward the small business community. It is designed to provide technical assistance to small businesses in maintaining safe and healthful workplaces. Consultants help employers to identify hazards and suggest ways to eliminate or control any unsafe conditions and practices. They assist in setting up safety and health management systems to prevent the recurrence of hazards. And they involve the employees at the site in the consultation process. In fact, the regulations governing the consultation program (found at 29 CFR 1908.6[c][1]) require as a precondition to a visit that the employer allow the consultant to confer with employees.

By presenting an insightful overview of possible administrative and legislative improvements in the OSHA program, the report offers much food for thought. We appreciate the assistance GAO has provided in our continuing efforts to seek new ways to improve safety and health in the workplace.

Sincerely yours,

GD Scannell

Gerard F. Scannell
Assistant Secretary

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Related GAO Products

How Well Does OSHA Protect Workers From Reprisals: Inspector Opinions (GAO/T-HRD-90-8, Nov. 16, 1989).

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